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February 12, 1960
Vol. 33. No. 2

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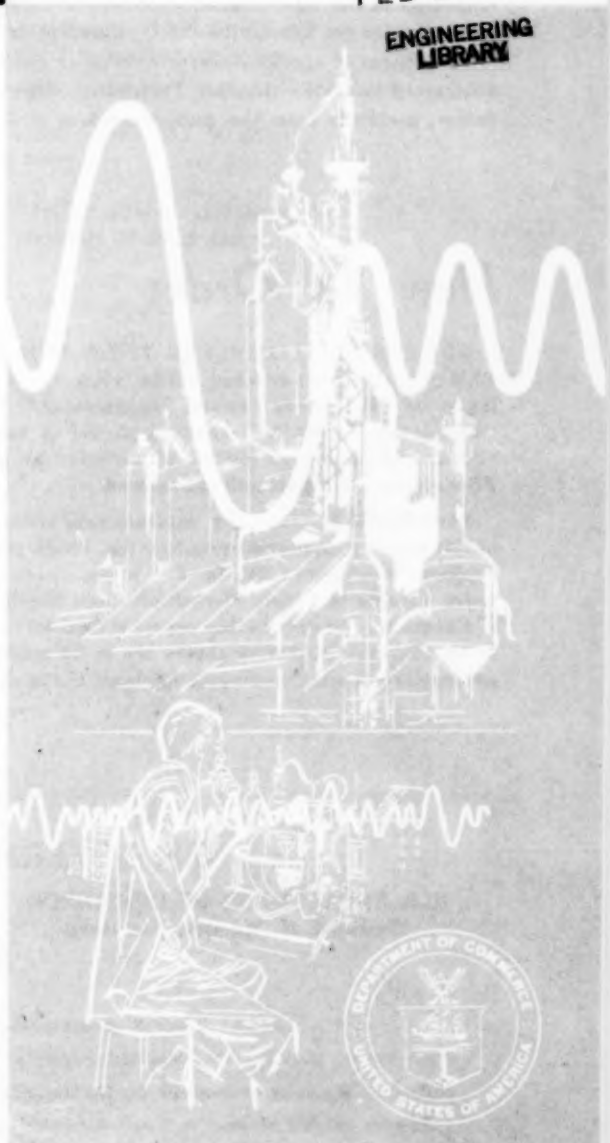

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OFFICE OF TECHNICAL SERVICES

Vol. 33, No. 2, Pp. 111-229 February 12, 1960

AGRICULTURE

Armour Research Foundation, Chicago, Ill.
TOXICITY OF BORON-OXYGEN COMPOUNDS TO PLANTS AND SOIL BACTERIA, by A. Shefner and R. Ehrlich. Final rept. on [Contract NOas-52-1024-c]. 30 May 57, 16p. 1 ref. CCC-1024-TR-251.
Order from LC mi$2.40, ph$3.30 PB 143 /12

A determination has been made of the response of various plants to various levels of applied boron compounds, in terms of yields of fresh weight of beans, radishes, lettuce, beets, and oats. The effects of adding boron at different stages of growth and the effectiveness of different methods of application were investigated. Boron adversely affected the growth of the plants tested when applied at levels between 8 and 32 pounds of boron per acre (lb. B/acre). Application of boric acid solutions to a variety of seeds germinating in pure quartz sand resulted in serious reduction in germination frequency. The effect of boron on the growth of three soil microorganisms, Azotobacter chroöcoccum, Streptomyces sp., and Rhizobium meliloti, was also determined.

ASTRONOMY

Astrophysics

Centro di Studio per la Fisica Delle Microonde (Italy).
THE DECELERATION OF METEORS DURING THEIR PASSAGE THROUGH THE EARTH'S ATMOSPHERE, by F. Verniani. Technical note no. 2 on Contract AF 61(052)227. June 59. 6p. 3 refs. AFCRC-TN-59-752.
Order from LC mi$1.80, ph$1.80 PB 143 922

The deceleration of meteors is computed theorically as a function of the characteristic quantities of evaporation, in particular, of velocity. It is shown that for over 3/4 of all meteors, the deceleration increases until the end of evaporation, and that, at the point of maximum rate of evaporation, the deceleration, as a first approximation, may be assumed the same for all meteors.

Harvard Coll. Observatory, Cambridge, Mass.
CLASSIFICATION OF SOLAR PROMINENCES-VII-1954, by Donald H. Menzel and F. Shirley Jones. Scientific rept. no. 13 on Contract AF 19(604)1394. [1958] 93p. AFCRC-TN-58-620; AD-206 783.
Order from LC mi$5.40, ph$15.30 PB 137 947

A tabulation and analysis is presented of the behavior classification of prominences observed at the High Altitude Observatory at Climax, Colorado, for the month of January, 1954, and at the Sacramento Peak Observatory, Sunspot, New Mexico, for the period January 23 to December 31, 1954. (See also PB 136 881)

Iowa State U., Iowa City.
OBSERVATIONS OF LOW ENERGY SOLAR COSMIC RAYS FROM THE FLARE OF 22 AUGUST, 1958, by K. A. Anderson, R. Arnoldy, and others (U. of Minnesota). [1959] 49p. 26 refs. SUI-59-9.
Order from LC mi$3.30, ph$7.80 PB 143 068

Observations have been made of protons at balloon altitudes in the energy range 100 to 300 Mev following a solar sequency of optical flare, r-f noise bursts and long enduring noise storm. Other particles are shown to have low upper limits to their abundance. The flare particles continue to be observed for at least 2 days and arguments are given to show that their storage and emission takes place in the solar atmosphere. The differential energy spectrum is derived from ionization versus atmospheric depth data and is found to be E^{-5} dE. Observations by riometer and VHF scatter propagation paths over the polar regions indicate that solar acceleration of protons up to roughly 100 Mev energy is rather frequent.

Maryland U., College Park.
FARADAY ROTATION OF RADIO WAVES WITHIN THE CRAB NEBULA, by Howard Laster and Allen M. Lenchek. Rept. on Contract AF 49(638)530, Feb 59, 5p. 10 refs. AFOSR-TN-59-164; AD-211 143.
Order from LC mi$1.80, ph$1.80 PB 144 029

Minnesota U. School of Physics, Minneapolis.
THE FLUX AND ENERGY SPECTRUM OF COSMIC RAY α-PARTICLES DURING SOLAR MAXIMUM, by P. S. Freier, E. P. Ney, and C. J. Waddington. Technical rept. on Cosmic Ray Program, Contract Nonr-710(19). Dec 58, 39p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 143 861

The fluxes of primary cosmic ray α-particles over Minnesota and Texas have been measured during the present period of maximum solar activity. A value of 136 ± 9 α-particles/m^2 sec ster was measured over Minnesota and of 68 ± 4 α-particles/m^2 sec ster over Texas. In both cases these values are significantly lower than those observed at solar minimum. The energy spectrum of these particles has been determined between 200 Mev/nucleon and 3.0 Bev/nucleon. It is shown that the slope of the integral spectrum is less than that observed at solar minimum and that a significant number of low energy particles is still present. A possible mechanism for these changes is discussed briefly. The determination of energies of particles from a measurement of their ionization is discussed in detail in an appendix.

Minnesota U. School of Physics, Minneapolis.
THE LITHIUM, BERYLLIUM AND BORON IN THE PRIMARY COSMIC RADIATION, by P. S. Freier, E. P. Ney, and C. J. Waddington. Technical rept. on Cosmic Ray Program, Contract Nonr-710(19). Dec 58, 29p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 143 932

In order to resolve the controversy concerning the abundance of the light elements ($3 \leq Z \leq 5$) in the primary cosmic radiation a further experiment has been performed. The charge spectrum of the cosmic radiation has been determined on October 19, 1957 in a stack of nuclear emulsions exposed nearer the top of the atmosphere than before. The results of the experiment prove that these light elements make up an appreciable fraction of all those nuclei with $Z \geq 3$ present in primary cosmic radiation.

Rochester U., N. Y.
SOME CONSIDERATIONS ON THE ANALYSIS OF PRIMARY COSMIC RAY INTENSITY EXPERIMENTS, by A. Engler, M. F. Kaplon, and J. Klarmann. Rept. on Contract AF 49(638)303. [1958] 34p. 22 refs.
AFOSR-TN-58-970; AD-205 597.
Order from LC mi$3.00, ph$6.30 PB 144 001

A discussion is given of the procedures employed in the analysis of primary cosmic ray intensity experiments and the assumptions inherent in their use, with particular emphasis on nuclear emulsion as a detector. Explicit formulas for extrapolation of particle intensities for various geometries employed in emulsion work are given. Some discussion of geomagnetic effects is given and data are presented showing that the earth's shadow cone is not appreciably present at a geomagnetic latitude of 40°.

BEHAVIORAL SCIENCES

Human Engineering

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
A GUIDE TO COLOR BANDING FOR INDICATORS (METERS), by William Wokoun and Gerald Chaikin. Mar 59, 11p. Technical Memo. 2-59.
Order from LC mi$2.40, ph$3.30 PB 143 130

This report presents a rationale for color-coded banding of meters. The principles set forth are illustrated, and swatches of the four colors which are considered maximally discriminable are given.

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE EFFECT OF DIFFERENT PROPORTIONS OF MONITORED ELEMENTS ON OPERATOR PERFORMANCE IN A SIMULATED RADAR AIR TRAFFIC CONTROL SYSTEM, by Robert G. Kinkade and J. S. Kidd. Rept. on Contract AF 33(616)3612. June 59, 17p. 11 refs. WADC Technical rept. 59-169.
Order from OTS $0.50 PB 161 111

A simulated radar approach control system was utilized to evaluate the influence of different levels of monitoring on system performance. Monitoring level was varied by manipulating the proportion of aircraft in the system having airborne position information (API) equipment. The API-equipped aircraft did not require active control of their approach path as did those aircraft without such equipment. Four conditions were compared: (a) 100%, (b) 63%, (c) 37%, and (Behavioral Sciences--Human Engineering, 12 Feb 60) (d) 0% of aircraft with API equipment. Eight laboratory-trained controllers participated. Results indicated an approximately linear increase in system performance as proportion of API-equipped aircraft was increased. Recommendations for future utilization of API in terminal operations were considered.

Personnel and Training

American Inst. for Research, Pittsburgh, Pa.
STUDIES OF NAVY GUIDED MISSILE TEAMS, by David J. Klaus and Robert Glaser. Final rept. for 1 May 51-31 May 58 on Contract N7onr-37008. 31 Dec 58, 26p. 47 refs.
Order from LC mi$2.70, ph$4.80 PB 143 615

This report consists of a brief summary of activities conducted as a research project and includes a digest of project activities, a short administrative history of the project, and an annotated bibliography of reports produced by the project staff.

Applied Psychological Services, Wayne, Pa.
POST-TRAINING PERFORMANCE CRITERION DEVELOPMENT AND APPLICATION: DEVELOPMENT AND APPLICATION OF TBCL CRITERIA TO THE SESR PROGRAM FOR THE AIR CONTROLMAN AND THE PARACHUTE RIGGER RATINGS, by Authur I. Siegel, Milton Richlin, and Philip Federman. Rept. on Contract Nonr-2279(00). Oct 58, 131p. 2 refs.
Order from LC mi$6.90, ph$21.30 PB 143 388

This is the second of a series of reports by Applied Psychological Services on the post-training performance of the enlisted personnel in certain naval aviation ratings. The present research had two general purposes: (1) measurement of the effects of the Selective Emergency Service Rate program (SESR) on the quality of the technical performance of the Air Controlman Tower (ACT) and Parachute Rigger Survival (PRS) ratings. (2) development of a criterion instrument applicable to the on-going measurement of the proficiency level of ACTs and PRSs who are graduates of the respective schools of the Naval Air Technical Training Command. Separate Technical Behavior Check Lists which seem to possess the attributes of analyzability, relevance, comprehensiveness, and correct weighting of elements were prepared for each rating. Adequate reliabilities were demonstrated for the lists. (See also PB 142 120 and 136 699)

Clark, David, Co., Inc., Worcester, Mass.
INTEGRATION OF PERSONAL EQUIPMENT. Rept. on Contract AF 33(616)3329. [Aug 59] 36p. WADC technical rept. 59-382.
Order from OTS $1.00 PB 161 132

This report covers the efforts, methods of approach and solutions to some of the problems of integrating items of aircrew personal equipment. The major problem of integration is the combining of the various individual items which have specific functions with each other without complicating these combinations beyond their effectiveness limits. Practical solutions were achieved in some areas, but additional work is required in others.

Washington U., Seattle.
THE SELECTION OF PREDICTORS FOR SOME EVALUATIONS OF FACULTY PERFORMANCE, by Clifford E. Lunneborg. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C2). Dec 57, 115p. 13 refs.
Order from LC mi$6.00, ph$18.30 PB 138 635

Relationships between some evaluations of faculty effectiveness and a number of items of information extracted from the background records of certain faculty members were investigated. Major emphasis in the study was placed upon the selection of predictors from among the items of background information to provide the best estimations of the faculty evaluations. An iterative predictor selection procedure was employed to select only those predictors which made significant independent contributions to these estimations. A criterion is presented, and was applied, for restricting the number of variates selected to prevent reliance of the obtained predictions on small sample error variance in the criterion measures. The results of these predictor selections are reported. Finally, explanations of certain of the findings and suggestions for extension of the research were offered.

Psychology

Applied Mathematics and Statistics Lab., Stanford U., Calif.
CHAINS OF INFINITE ORDER AND THEIR APPLICATION TO LEARNING THEORY, by John Lamperti and Patrick Suppes. Technical rept. no. 18 on Contract Nonr-225(17). 15 Oct 58, 29p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 143 701

The purpose of this paper is to study the asymptotic behavior of a large class of stochastic processes which have been used as models of learning experiments. By applying a theory of chains of infinite order, or "chaînes à liaisons complètes" namely, certain limit theorems for stochastic processes whose transition probabilities depend on the entire past history of the process, but only slightly on the remote past. A self-contained discussion of these and some additional results is the content of Section 2.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
FOUNDATIONS OF STATISTICAL LEARNING THEORY, I. THE LINEAR MODEL FOR SIMPLE LEARNING, by W. K. Estes (Indiana U.) and Patrick Suppes. Technical rept. no. 16 on Contract Nonr-225(17). 20 Nov 57, 101p. 14 refs. AD-149 728.
Order from LC mi$5.70, ph$16.80 PB 137 998

Primitive notions, the axiomatic structure, and general theorems are presented of a model which formalizes and generalizes models for simple learning; the mathematical foundations of these models are examined. The formulation draws upon the concepts and methods developed by R. R. Bush and F. Mosteller (Stochastic models for learning, New York, 1955) and W. K. Estes and C. J. Burke (Psychol. Rev. 60:276-286, 1953). A study is made of the sample spaces of the stochastic processes involved, and the methods of defining events and probabilities. The theorems are derived by set-theoretical and probabilitic techniques. The discussion is limited to linear models. The level of generality is that of a model broad enough to include as special cases all of the particular linear models which have been applied to learning experiments.

Arctic Aeromedical Lab., Ladd AFB, Alaska.
A PRELIMINARY STUDY OF THE MOTIVATIONAL PROPERTIES OF COLD STRESS, by Robert B. Payne. Apr 59, 13p. 12 refs. Technical rept. 58-9.
Order from LC mi$2.40, ph$3.30 PB 143 345

An experiment was conducted for the purpose of noting (a) whether cold exposure can be regarded as having drive properties sufficient for the motivation of a rote learning process, and (b) whether the drive properties of cold exposure are modified by the factor of cold acclimatization. Five male subjects underwent thermophysiological changes characteristic of cold acclimatization by means of rigorous physical training followed by prolonged field exposure to sub-zero temperatures. The temperature effect was significant at the 5 percent level, but only for the acclimatized subjects. They learned faster under the lower temperature condition on both occasions. The results agree well with those observed in the operant behavior of rats in low temperatures under radiant heat reinforcement, and they lend themselves to the interpretation that cold exposure generates a more effective drive stimulus for acclimatized subjects because acclimatized subjects actually lose more heat under cold stress than do their nonacclimatized controls.

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
RELATIONSHIPS OF INTERMITTENT NOISE, INTER-SIGNAL INTERVAL AND SKIN CONDUCTANCE TO VIGILANCE BEHAVIOR, by Joseph F. Dardano and Irving Mower. July 59, 29p. 11 refs. Technical Memo. no. 7-59.
Order from LC mi$2.70, ph$4.80 PB 143 531

Relationships of intermittent, low intensity, ambient, white noise, inter-signal interval variability and basal skin conductance to prolonged observation were investigated. Observers were required to differentiate a total of 180 critical signals which differed from periodically blinking background signal only by a larger amplitude. Performance was measured by reaction time. Monitoring performance did not deteriorate with low variability of inter-signal intervals, 50 to 70 sec. Intermittent noise impaired performance with this schedule by slightly increasing reaction times during the entire session. With a greater variability of inter-signal intervals, performance deteriorated continuously during the vigil and was unaffected by intermittent noise. A minimum interstimulus interval of 30 sec. resulted in an inverse relationship between reaction time and length of interstimulus interval, at least up to the mean interval. Basal skin conductance was negatively correlated with logarithm of reaction time when performance deteriorated under a signal schedule requiring continuous observation.

Bethany Coll., W. Va.
ON THE SPAN OF A SEARCH MECHANISM IN PROBLEM SOLVING, by Wilbert S. Ray. Technical rept. no. 1 on Contract Nonr-2315(00). Dec 58, 9p 2 refs.
Order from LC mi$1.80, ph$1.80 PB 143 927

This paper reports an attempt to manipulate the span of the search mechanism, and the size of the relation to be discovered. The size of the relation is defined as the number of elements among which the relation holds.

Harvard Graduate School of Education, Cambridge, Mass.
STAGES IN THE DEVELOPMENT OF VOCATIONAL SELF CONCEPT IN ADOLESCENCE, by Robert P. O'Hara (Boston College) and David V. Tiedeman. Rept. no. 7 on Harvard Studies in Career Development; Technical rept. no. 3 on Contract Nonr-1866(31). Nov 58, 23p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 143 461

In an attempt to give an empirical formulation to self concept theory in the realm of vocational development, we have defined self concept as an individual's evaluation of himself. Using this definition we have investigated the areas of aptitude, interest, social class, and values. Previous research has shown that these areas are important in the development of careers. The research reported here not only measures the individual's standing in these four areas but adds a further dimension - a measure of the person's ability to evaluate his standing. Such a dimension is essential to an understanding of the way in which a person solves the occupational choice problem which he is facing. Hence it further illuminates the influence of these factors in occupational choice.

Illinois U., Urbana.
INTERPERSONAL PERCEPTION AND INTERPERSONAL RELATIONSHIPS IN THERAPEUTIC COUNSELING, by J. McV. Hunt. Annual rept. no. 2 on Contract Nonr-1834(11). 15 Nov 58, 56p. 11 refs.
Order from LC mi$3.60, ph$9.30 PB 143 434

Points covered are:
Introduction
Notation
D^2 - correlations as a function of item-correlations
Correlation studies of D^2
Method
Summary of factor construction
Calculation of components and their intercorrelation
Results: Comparison of Cross-Factor Correlations
Summary of D^2 "generality" as opposed to component "generality"
Correlations of D^2 with its components
Discussion
Suggested research program
Appendix A: Derivations
Appendix B: Summary of errors
Appendix C: Example of reversal of correlations
Bibliography

Human Resources Research Center, Lackland AFB, San Antonio, Tex.
PSYCHOMOTOR PERFORMANCE AS A FUNCTION OF INITIAL LEVEL OF ABILITY, by Bradley Reynolds and Jack A. Adams. Oct 53, 28p. 14 refs. Research bulletin 53-39.
Order from LC mi$2.70, ph$4.80 PB 144 211

The present study was designed to test the hypothesis that the general laws of learning are independent of individual differences in the field of psychomotor learning. The plan of the study reported has involved training a group with massed practice and a group with distributed practice. Upon completion of this study, each group was divided into subgroups on the basis of initial level of ability in the task. The acqui-

sition curves obtained for the ability subgroups were examined for systematic differences in performance. Tables and graphs present the results.

Institute for Research in Social Science, U. of North Carolina, Chapel Hill.
ANNUAL TECHNICAL REPORT. Rept. on Contract Nonr-855(04). Nov 58, 9p. 10 refs. AD-205 750.
Order from LC mi$1.80, ph$1.80 PB 143 471

Contents:
Psychological set and social conformity
The effect of threat to group status on group performance strategies
Surveillance and trust
Reaction to unfavorable personal evaluation as a function of the evaluator's perceived adjustment
The group member's response to hostility as a function of his perceived support for its instigation
A self-scored measure of achievement and affiliation motivation
The effects of 3 schedules of reinforcement and individual motivation on perception of performance and risk-taking behavior
Political orientation and the perceptual effect of an anticipated interaction
The adaptiveness of groups of changing task demands under various conditions of social communication
Communication and social control
Types of learning in 3-person interaction
Group structure and communication
The American University as a behavioral system

Laboratory for Research in Social Relations, U. of Minnesota, Minneapolis.
COGNITION, MOTIVATION AND TIME PERCEPTION, by Peter Schönbach. Technical rept. no. 2 on Research Studies on the Relation Between Cognition and Behavior, Contract N8onr-662(16). Nov 58, 20p. 15 refs.
Order from LC mi$2.40, ph$3.30 PB 143 421

An exploratory study by Schachter on social isolation suggested two hypotheses: (1) The force acting on a person in a barrier situation to reach a goal (G) is an increasting function of the person's need for G "times" the relevance of this person's ideation with respect to G. (2) The greater within limits the magnitude of the force acting on a person in a barrier situation to reach a goal, the greater will be this person's estimate of the time spent in that barrier situation.

Michigan State U., East Lansing.
MATHEMATICAL MODELS FOR HUMAN GROUP ORGANIZATION, by Leo Katz. Final rept. on Contract Nonr-785(00). 12 June 58, 45p. 5 refs.
Order from LC mi$3.30, ph$7.80 PB 143 120

Personnel Lab., Wright Air Development Center, Lackland AFB, Tex.
PREDICTION OF CREATIVITY IN A SAMPLE OF RESEARCH SCIENTISTS, by Cecil J. Mullins. Feb 59, 17p. 6 refs. WADC Technical note 59-36; AD-211 039.
Order from LC mi$2.40, ph$3.30 PB 144 210

In an attempt to identify test predictors of scientific creativity, two criteria of creativity were used: supervisors' ratings and number of publications. An interest questionnaire, a vocabulary test, and nine tests of the Guilford Creativity Battery were administered to 131 research physical scientists. Of 42 test scores derived from the battery, four were significantly related to the rating criterion and seven to the publications criterion. The two criteria were not significantly with both criteria. A composite predictor gave promise of increasing effective prediction of the ratings criterion, but not of the publications criterion.

Washington U., Seattle.
A COMPARISON OF EPPES SCORES OBTAINED FROM THE STANDARD FORCED-CHOICE PROCEDURE AND A RATING-SCALE PROCEDURE, by Chadwick Karr. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). Oct 58, 96p. 28 refs.
Order from LC mi$5.40, ph$15.30 PB 143 711

The present investigation is concerned with two separate problems arising from Wright's work. Can one devise a method of scoring responses given to separate EPPS (Edwards Personal Preference Schedule) statements such that the scores for variables will correlate more highly (than Wright's normative-ipsative scores) with conventional EPPS scores for corresponding variables? Wright showed that the factor structure of the matrices of variable scores for the rating scale and the EPPS were not identical. Presumably, one of the major differences lay in the presence of one or more SD factors in the rating-scale score matrix. Can one determine more precisely what reliable systematic variance is present in variable scores from statements rated one at a time which is not present in forced-choice EPPS variable scores, and vice versa?

Yale U., New Haven, Conn.
FIVE STUDIES OF THE RELATION BETWEEN SEX-ROLE IDENTIFICATION AND ACHIEVEMENT IN PROBLEM SOLVING, by G. Alexander Milton. Technical rept. 3 on Contract Nonr-609(20). Dec 58, 76p. 17 refs. AD-218 597.
Order from LC mi$4.50, ph$12.30 PB 143 847

Contents:
Achievement in problem solving as related to sex-role identification
Sex differences in problem solving and role appropriateness of problem content
Choice of strategy for solving problems and sex role
Sex differences in problem solving as related to role appropriateness of problem content and to availability of manipulative materials
Sex differences in problem solving and role appropriateness of problem content: a replication

Yale U., New Haven, Conn.
RESEARCH PROGRAM ON AFFECTIVE AND COGNITIVE ASPECTS OF ATTITUDE CHANGE, by Milton J. Rosenberg. Annual rept. for Sep 57-Dec 58 on Contract Nonr-609(27). [1959] 17p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 143 862

Contents:
Cognitive reorganization in response to the hypnotic manipulation of attitudinal affect
Investigations into the dynamics of the hypnotic process
Investigations into structural and dynamic aspects of "cognitive balancing"
The relation of variation in self-esteem to opinion change

BIOLOGICAL SCIENCES

Iowa State U. of Science and Tech., Ames.
SOME FAMILIES OF CONTAGIOUS DISTRIBUTIONS, by S. K. Katti and John Gurland. Rept. on Contract AF 49(638)43. [1958] 46p. 10 refs. AFOSR-TN-59-4; AD-208 184.
Order from LC mi$3.30, ph$7.80 PB 143 362

The purpose of the research in this paper includes the consideration of the following questions: To study some families of contagious distributions from the point of view of their derivation. To compare these distributions using characteristics such as skewness, kurtosis, and the ratio of frequencies. To estimate the parameters by various methods in order to gain some empirical evidence about their relative merits. To compare fits using chi-square and to see if any general conclusions can be suggested on an empirical basis regarding the best fit.

Pennsylvania U., Philadelphia.
PROPERTIES OF BIOLOGICAL MATERIALS, by Herman P. Schwan. Annual progress rept. for 1958 on Contract Nonr-551(05). 5 Dec 58, 8p.
Order from LC mi$1.80, ph$1.80 PB 143 850

Summary of work done to measure and analyze the electric and acoustic impedance of biological material in the electrical frequency range from 10 Mc to 1000 Mc and in the acoustic frequency range from 200 Kc to 10 Mc.

School of Aviation Medicine, Randolph AFB, Tex.
BIOASTRONAUTICS: ADVANCES IN RESEARCH. Mar 59, 184p. 15 refs.
Order from LC mi$8.40, ph$28.80 PB 143 923

In this publication fifteen special progress reports are published which deal with problems immediately applicable in rocket flight and satellite flight. Others report about progress in fields which will be of usefulness in more advanced space operations. All of these special reports may serve as a source of information for physiologists and physicians working in space medicine or bioastronautics, and also to the physical scientists, rocket engineers, military officials and government administrators concerned with the national space program.

Anatomy and Physiology

California U., Los Angeles.
TECHNICAL STUDIES ON CARGO HANDLING, VI. BIBLIOGRAPHY OF HUMAN ENERGY EXPENDITURE LITERATURE, by Frank C. Hale. Rept. on Contract Nonr-233(07). Oct 58, 116p. 880 refs. Dept. of Engineering rept. 58-68.
Order from LC mi$6.00, ph$18.30 PB 143 700

A bibliography of literature related to human energy expenditure, its parameters and measures, is presented through December 1957. A cross reference index is provided. (See also PB 133 230)

California U., Los Angeles School of Medicine.
THE EFFECT OF VARIOUS STRESSES ON THYROID FUNCTION IN MAN AND IN ANIMALS, by David H. Solomon, Leslie R. Bennett, and Delores E. Johnson. Annual progress rept. for 1 Apr 58-31 Mar 59 on Contract Nonr-233(36). 1 Dec 58, 7p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 143 845

Cornell U. [Ithaca, N. Y.]
OPTICAL MOTIONS AND TRANSFORMATIONS AS STIMULI FOR VISUAL PERCEPTION. Research rept. on Visual Perception of Motion and Space, Contract Nonr-401(14). Sep 56, 15p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 128 818

Human Resources Research Center, Lackland AFB, San Antonio, Tex.
TESTS OF MOTOR ABILITY OR GROSS MUSCULAR COORDINATION, by Merrell E. Thompson, Jean P. Thompson, and E. Ralph Dusek (U. of Arkansas). Rept. on Contract AF 33(038)22948. July 53, 39p. 255 refs. Research bulletin 53-25.
Order from LC mi$3.00, ph$6.30 PB 144 212

The descriptive material of the present review is primarily concerned with those tests which are currently being used with males of military age and which appear to measure, primarily, some aspect of gross muscular coordination. In terms of the conventional categories set up by the physical education writers, this has meant, in general, the inclusion of tests of motor educability, motor capacity, motor fitness, motor ability, and strength (where measured by some activity rather than by dynamometers); and the exclusion of endurance tests, specific skill or achievement tests, and cardiovascular tests of fitness. In the interest of completeness, a number of early tests are briefly described and the early testing movement is outlined. Certain tests which have been developed and standardized primarily for use with high school boys, are included in Appendix B. Other tests, less pertinent to the inquiry, have been indicated only in the Bibliography.

Institute of Optics, U. of Rochester, N. Y.
STUDY OF VISUAL STEREOSCOPIC ACUITY, by V. J. Carpenter and N. D. Miller. Final technical rept. for 15 June 56-15 Feb 58 on Contract DA 44-009-eng-2882. 15 Mar 58, 53p. 1 ref.
Order from LC mi$3.60, ph$9.30 PB 143 663

This report presents the analysis of 47,000 of the settings made by thirty of the observers after their training and practice sessions, using seventeen different viewing conditions. The targets used in the comparison of conditions were six miniature tents photographed against a model of hilly terrain and oriented such that their ridges were in the direction of flight. Ten settings were made on each target in random order by each observer for every viewing condition. The standard deviations for the individual tar gets were computed and averaged to yield an index of the accuracy of measurement for the different conditions.

Iowa State U., Iowa City.
THE TRANSFER OF ENERGY ACROSS THE COCHLEA, by Juergen Tonndorf. Mar 59, 12p. 14 refs. AFSAM rept. 59-49.
Order from LC mi$2.40, ph$3.30 PB 143 370

Two concepts concerning different aspects of cochlear function are in an apparent conflict: the pressure-wave concept (which maintains that the acoustic energy entering the cochlea by the oval window must leave in toto by the round window) and the traveling-wave concept of Bekesy. If the latter would really entail the progression and dissipation of energy in the direction of the helicotrema (according to the common definition of wave travel), this energy would have to be diverted from the pressure wave. The dilemma is solved by consideration of fluid motion in cochlear models. Energy is transferred from the vestibular scala across the partition to the tympanic scala. In this process the partition responds to the velocity of the fluid motion.

The latter fact accounts for the shape of the envelope over the traveling waves. The finding that the amplitude of fluid motion in both scalae decreases in a fenestro-apical direction is accounted for by the Reciprocity Theorem of Helmholtz.

Vision Research Labs., U. of Michigan, Ann Arbor.
APPLICATION OF PROBIT ANALYSIS TO PSYCHOLOGICAL DATA: I. TECHNIQUES FOR DESK COMPUTATION, by W. M. Kincaid and H. R. Blackwell. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Sep 58, 24p. 14 ref. Rept. no. 2144-283-T.
Order from LC mi$2.70, ph$4.80 PB 143 415

Psychophysical data collected in studies of visual detection are routinely subjected to probit analysis. This analysis involves fitting a cumulative normal distribution function to the experimental data, in accordance with the principle of maximum likelihood. The application of this principle required the solution of a set of simultaneous equations. An iterative procedure for solving these equations with the aid of desk calculators is described in the present report.

Vision Research Labs., U. of Michigan, Ann Arbor.
APPLICATION OF PROBIT ANALYSIS TO PSYCHOPHYSICAL DATA: II. TECHNIQUES FOR THE MICHIGAN DIGITAL AUTOMATIC COMPUTER (MIDAC), by Anne B. Moldauer and Wilfred M. Kincaid. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Jan 59, 16p. 3 refs. Rept. no. 2144-289-T.
Order from LC mi$2.40, ph$3.30 PB 143 443

The Vision Research Laboratories have successfully developed two programs for carrying out probit analyses of visual detection data on high-speed computers. The first procedure, patterned closely on that used with desk computers, proved to have a number of drawbacks; the second procedure, more specifically adapted for automatic computers, proved successful when used on the Michigan Digital Automatic Computer (MIDAC). (See also PB 143 415)

Vision Research Labs., U. of Michigan Ann Arbor.
THE DESIGN AND CALIBRATION OF A SPECTRAL COMPARATOR FOR MEASURING VISUAL LUMINOSITY FUNCTIONS, by B. S. Pritchard. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Nov 58, 19p. 1 ref. Rept. no. 2144-336-T.
Order from LC mi$2.40, ph$3.30 PB 143 445

The Spectral Comparator is an instrument which has been developed for measurement of the luminosity functions of human observers. The optical system is described, and the methods are explained by which the radiances of the two visual fields were measured for various settings of the controls on the instrument. The results of the measurements are presented in tabular and in graphical form for use in studies of the luminosity function to be reported subsequently from these laboratories.

Vision Research Labs., U. of Michigan, Ann Arbor.
THE DETECTABILITY OF TARGETS CONTAINING INTERNAL LUMINANCE GRADIENTS, by A. B. Kristofferson and R. H. O'Connell. Rept. on Proj. Michigan, Contract DA 36-039-sc-52654. Sep 58, 17p. 9 refs. Rept. no. 2144-297-T.
Order from LC mi$2.40, ph$3.30 PB 143 414

Detection thresholds were measured for thirteen nonuniform targets consisting of a circular area approximately 60 minutes in diameter, on the center of which a circular luminance increment approximately 4 minutes in diameter was super-imposed. The ratio of center to annular luminance ranged between 1.0 and infinity. Predictions of the luminance of the center area required for the entire target to be at detection threshold were made from the values of threshold luminance of the center and annulus presented singly, on the basis of several variants of the element contribution hypothesis. The prediction which assumes that effective sensory excitation increases with the square of target luminance was favored over the prediction assuming a linear relation.

Air Force Missile Development Center, Holloman AFB, N. Mex.
CENTRIFUGE EXPERIMENTS ON HIGH-G LOADS IN MICE AND THEIR POSSIBLE ALLEVIATION BY MULTIDIRECTIONAL ANTI-G DEVICES, by H. J. von Beckh and Grover J. D. Schock. Aug 58, 18p. 8 refs. AFMDC TN-58-10; AD-154 104.
Order from LC mi$2.40, ph$3.30 PB 138 951

Using the centrifuge, time-tolerance limits on transversely positioned mice were studied and the results compared with longitudinal G-tolerance values reported by other authors. The possibilities of a multidirectional G-protection during escape trajectories and the re-entry phase are discussed.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
AFOOT IN THE DESERT: A CONTRIBUTION TO BASIC SURVIVAL, by Alonzo W. Pond. Mar 51, rev. Apr 56, 62p. 17 refs. Publication no. D-100.
Order from LC mi$3.90, ph$10.80 PB 143 817

Recent scientific studies on water and heat exchanges in the human body make the old desert theories about thirst and ancient ideas on desert travel out of date. This report is written to bring men in the Air Force up to date on desert living conditions. It is intended to provide basic information for escape and evasion in desert regions. It makes available the most recent, reliable information concerning survival needs of the human body in the deserts of the world.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
DOWN IN THE NORTH: AN ANALYSIS OF SURVIVAL EXPERIENCES IN ARCTIC AREAS, by Richard A. Howard. Apr 53, 55p. Publication no. A-103.
Order from LC mi$3.60, ph$9.30 PB 143 820

This analysis of Arctic survival narratives will be indispensable to all those concerned with Arctic operations. The planners, the instructors, the briefers, and above all those who have the privilege of going into the North will benefit most from the accomplishments and profit best from the mistakes of those who went before.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
999 SURVIVED: AN ANALYSIS OF SURVIVAL EXPERIENCES IN THE SOUTHWEST PACIFIC, by Richard A. Howard. 1958, 66p. 36 refs. Pub. no. T-100.
Order from LC mi$3.90, ph$10.80 PB 143 819

This study is an instructive and eminently readable account of survival incidences in the Southwest Pacific and China-Burma-India theatres and an important source of information to all concerned with briefing fliers and passengers for travel in the regions under consideration, and to all instructors of survival techniques; furthermore, it will be a reliable guide in shaping the course programs of survival training schools.

Arctic, Desert, Tropic Information Center, Air U., Maxwell AFB, Ala.
SUN-SAND AND SURVIVAL: AND ANALYSIS OF SURVIVAL EXPERIENCES IN DESERT AREAS, by Richard A. Howard. Jan 53, 50p. 10 refs. Publication no. D-102.
Order from LC mi$3.30, ph$7.80 PB 143 818

Sun, Sand and Survival will contribute materially to the briefing of pilots and crews who operate over desert terrain. It gives firsthand information on what to expect in a great variety of desert areas. It shows definitely that deserts are not all alike. Used in connection with ADTIC Publication D-100 Afoot in the Desert (PB-143 817) and Air Force Manual 64-5 Survival (PB-112 819) it gives the reader a thorough grasp of techniques and procedures of desert survival.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
G TOLERANCE IN PRIMATES: II. OBSERVATIONS IN THE RELATIONSHIP OF CAROTID PRESSURE AND END POINT DURING ACCELERATION, by George H. Kydd, Richard L. Fenichel, and Richard J. Crosbie. Rept. no. 2 on Proj. NM 11 01 12.9. 29 May 59, 18p. 6 refs. NADC-MA-5903.
Order from LC mi$2.40, ph$3.30 PB 143 432

Observations have been made simultaneously of the occurrence of an end point of unconsciousness and carotid pressure in Rhesus monkeys during centrifugation. The data indicate that the carotid pressure is influenced initially by a maneuver which gives rise to a positive wave of pressure that is well coordinated with the onset of tangential G. Following this, there is a phase of pressure drop that can be described by a single time constant which varies with G. The data indicate that the end point occurs at a constant time following this occurrence of the pressure minimum and therefore is related to the slope of the blood pressure curve. The significance of this observation with respect to the blood supply is discussed.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
RELATIONSHIPS BETWEEN SEMICIRCULAR CANAL FUNCTION AND OTOLITH ORGAN FUNCTION, by R. F. Gray. Rept. no. 8 on Proj. NM 17 01 12.1. 8 Sep 59, 17p. 7 refs. NADC-MA-5911.
Order from LC mi$2.40, ph$3.30 PB 143 825

Data are reviewed indicating human response which may be the combined result of stimulation of both the otolith organs and the semicircular canals. Also some responses attributed to semicircular canals are shown to be similar to those attributed to otolith organ stimulation and vice versa.

Biochemistry

Illinois U. Coll. of Medicine, Chicago.
CHOLESTEROL METABOLISM, by A. C. Ivy. Final rept. for 15 Aug 57-14 Jan 58 on Contract AF 49(638)242. 1 July 59. 58p. 84 refs. AFOSR-TR-59-79; AD-219 391.
Order from LC mi$3.60, ph$9.30 PB 143 736

Six hundred thirty-eight one-week old chicks were fed for 12 weeks a basal diet (B. D.) containing 23% protein, 3% fat and 0.05% cholesterol. Seventy-seven were fed the B.D. alone. The remainder were divided into groups of 25 or more and given cholesterol (2%), or beef tallow (5%) (m.p. 42° C), or stearic acid (10%), or palmitic acid (20%, 5 wk.); or cholesterol (2%) plus tallow, or soya oil (5%), or safflower oil (5%), or hydrogenated soya oil (5%) (m.p., 33° C); or niacin (1%) plus cholesterol (2%), or niacin (1%) plus cholesterol (2%) plus either tallow, soya oil, or safflower oil. Chemical analyses of the blood serum for cholesterol, and of the liver and arteries for cholesterol and total lipids were made. The arteries were graded for the severity of macroscopic atheromatosis. Like all ordinary food fats, soya and safflower oil and tallow enhanced the hypercholesterolemic and atherogenic effects of cholesterol. Stearic and palmitic acid slightly decreased these effects of cholesterol. When the concentration of cholesterol in the diet is greater than 1% by weight, the concentration of cholesterol in the liver, serum and arteries plateaus, indicating the existence of an intestinal capacity to absorb cholesterol. Our evidence and that in the literature indicates that at a 0.25% (dry weight) level of cholesterol in the diet, cholesterol starts to accumulate in the liver, blood serum and arteries. This is before the intestinal capacity for the absorption of cholesterol in the chicken is reached and without hepatic synthesis being suppressed by dietary cholesterol. The accumulation of cholesterol in the body starts when a 1900 gm cockerel absorbs about 48 mg/day which is twice the average amount of digitonin precipitable sterol excreted daily by the chicken on a sterol-free diet, namely, 24mg. According to this, a normal 150 lb man should show little or no slow accumulation of cholesterol in the body until the daily average dietary intestinal absorption is above 400 or 600 mg and the intake is from 800 to 1000 mg. A good correlation exists between the concentration of cholesterol in the liver and arteries. Niacin (1%) reduced the accumulation of cholesterol in the arteries, liver and serum when cholesterol was fed alone or with soya or safflower oil but not with tallow.

St. Luke's Hospital, New York.
PROTEIN AND AMINO ACID NUTRITION, by Anthony A. Albanese. Annual progress rept. for 1 Jan-31 Dec 58 on Contract Nonr-1167(00). 15 Dec 58, 14p.
Order from LC mi$2.40, ph$3.30 PB 143 860

Although prime concern remains with human needs for proteins and specific amino acids under various pathological and physiological conditions, this report shows that more and more attention is being given (a) to the effects of proteins and amino acids on other body constituents, and (b) to the effects of various agents on the nitrogen needs of man.

New York U., N. Y.
STUDIES OF ENZYME SYSTEMS INVOLVED IN BIOLOGICAL OXIDATIONS AND SYNTHESES, by Severo Ochoa. Terminal rept. for 1957-1958 on Contract Nonr-285(31). [1958] 9p.
Order from LC mi$1.80, ph$1.80 PB 143 851

The problems investigated are: Enzymatic mechanisms of propionic acid oxidation in animal tissues; Enzymatic synthesis of ribonucleic acid, and Protein biosynthesis.

General Biology

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A STABLE CONTINUOUSLY RECORDING ELECTRODE SYSTEM FOR THE DETERMINATION OF OXYGEN DISSOLVED IN PROTEIN SOLUTIONS, by Freeman W. Cope. Rept. no. 7 on Proj. NM 11 01 12.7. 20 July 59, 13p. 4 refs NADC-MA-5912.
Order from LC mi$2.40, ph$3.30 PB 143 431

A system is described that will continuously measure the concentration of oxygen dissolved in a protein solution. The system is stable within 2% for periods of 30 minutes or more. The circuit diagram of a suitable amplifier is given. To attain stability of electrode current it is necessary that the amplitude of vibration of the silver-platinum electrode pair be kept constant by mechanical and electrical methods. The electrodes must be coated with collodion to prevent poisoning by proteins. A coating of silver salt must be deposited on the silver electrode before use.

Pacific Science Board, National Research Council, Washington, D. C.
ATOLL RESEARCH BULLETIN NOS. 48-50. Rept. on Contract N7onr-29154. 30 June 56, 252p. 55 refs.
Order from LC mi$11.10, ph$39.60 PB 128 595

Contents:
Bull. 48. The Geography of Kapingamarangi Atoll in the Eastern Carolines, by Herold J. Wiens
Bull. 49. Bioecology of Kapingamarangi Atoll, Caroline Islands: Terrestrial Aspects, by William A. Niering
Bull. 50. Geology of Kapingamarangi Atoll, Caroline Islands, by Edwin D. McKee
(See also PB 123 203)

Microbiology

[Army] Chemical [Warfare] Labs. [Army Chemical Center] Md.
PRINCIPLES AND PRACTICE OF BW DECONTAMINATION. 4. AN EVALUATION OF THE USE OF MEMBRANE FILTERS IN QUANTITATIVE BACTERIOLOGY, by Dorothy M. Portner, Elizabeth C. Mayo and Saul Kaye. 4 June 53, declassified 25 Jan 54, 50p. 15 refs. Biological Labs. Interim rept. no. 32.
Order from LC mi$3.30, ph$7.80 PB 143 534

The work here reported, which constitutes a necessary preliminary to an investigation of the use of membrane filters for the quantitative evaluation of disinfectants, covers a study of the relative bacterial recoveries obtainable, by several different techniques, with MF's and with pour plates. Bacterial recoveries are compared by statistical analysis of the experimental data. Although essentially the same bacterial recovery is obtained by any of the three MF techniques used ("1 ml direct", "1 ml in 4", and "1 ml in 4 + Rinses"), the "1 ml in 4" MF technique is the most generally satisfactory for the recovery of bacteria exposed to a disinfectant where the use of pour plates is undesirable. This technique involves placing 1 ml of the suspension to be counted in 4 ml of diluent and pouring the whole volume through the MF. The standard "1 ml direct" pour plate technique gives a better estimate of the number of bacteria in the control samples than does the "1 ml in 4" pour plate technique. All three MF techniques give lower bacterial recoveries than the "1 ml direct" pour plate technique and higher recoveries than the "1 ml in 4" pour plate technique. The bacterial recovery obtained differs with the test organism used. The use of "fresh" rather than stored slants of vegetative organisms seems to be advisable when high accuracy is desired. The relative bacterial recoveries of MF's and pour plates are summarized by straight line equations. These equations provide a means whereby, within the experimental range, any MF of pour plate values from tests involving B globigii spores of M pyogenes var aureus may be interconverted, with the degree of dependability represented by the appropriate 95% confidence limits also given.

[Army Chemical Warfare Labs., Army Chemical Center,] Md.
A SURVEY IN THE PHILADELPHIA AREA OF THE OCCURRENCE AND DISTRIBUTION OF BACILLUS ANTHRACIS IN TEXTILE MILLS USING GOAT HAIR AND WOOL, by Charles H. Harp, David F. Hershey, and Frank Novak. Oct 55, 27p. Special rept. 240.
Order from LC mi$2.70, ph$4.80 PB 143 695

This survey was made to obtain background information for guidance in formulating the test program for evaluating the anthrax vaccine. Table I summarizes available information on the number of infections. Part of the survey consisted of taking swab samples of the hands and arms, face and neck, and the external nares of the employees. Figures 1 and 2 show the physical layout of Plants A and B respectively with regard to each of the processes described. A brief description of each of the processes is given together with procedures of survey, isolation and identification of B Anthracis and results.

Chicago U., Ill.
FACTORS RESPONSIBLE FOR RESISTANCE TO ENTERIC INFECTION. THE ROLE OF THE INTESTINAL MICROFLORA IN RESISTANCE TO ENTERIC INFECTION, by C. Phillip Miller. Final rept. on Contracts N6ori-020(59) and N6ori-020(49). [1958] 4p.
Order from LC mi$1.80, ph$1.80 PB 143 419

An explanation for the enhanced susceptibility of mice to Salmonella infection which follows treatment (by mouth) with streptomycin.

Neurology and Psychiatry

California U., Los Angeles, School of Medicine.
NERVOUS CONTROL OF SHIVERING; A MANUAL FOR THE CONSTRUCTION, USE AND INTERPRETATION OF RECORDS FROM STAINLESS STEEL MICROELECTRODES, by Walter J. Freeman and Allan Hemingway. May 59, 37p. 38 refs. Arctic Aeromedical Lab. technical rept. 58-1; AD-220 680.
Order from LC mi$3.00, ph$6.30 PB 143 528

Detailed instructions are given for the construction and use of stainless steel microelectrodes. Information is also given on the recognition of noise and artifacts, on the analysis of action potentials recorded by this means, and on the problems likely to be encountered in localizing cell discharges in the brain and correlating them with physiological changes in other parts of the body.

Yale U. School of Medicine, New Haven.
TRANSFER FUNCTION OF A BIOLOGICAL PHOTORECEPTOR: ONE OF A SERIES OF REPORTS PERTAINING TO CYBERNETIC STUDIES OF A BIOLOGICAL PHOTORECEPTOR, by Lawrence Stark. Rept. on Research on Physics and Chemistry of Neurosensory Processes, Contract AF 33(616)5708. Aug 59, 29p. 20 refs. WADC Technical rept. 59-311.
Order from OTS $0.75 PB 161 131

A biological transducer of electromagnetic radiation energy to pulse rate modulated nerve impulse signals has been selected for study because of its lack of complex specialized accessory mechanisms. This simple crayfish photosensitive ganglion was subjected to a steady state analysis relying mainly on sinusoidal input light signals. The output signals of the population of nerve fibers were analyzed to yield a linear transfer function over the frequency range studied.

$$G(s) = \frac{ke^{-0.5s}}{(1+1.1s)}$$

The significance of these results, their context in neurophysiology, and possible direction for further investigations are discussed.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A PHYSIOLOGICAL END POINT FOR THE STUDY OF THE TOLERANCE OF SMALL MAMMALS TO HIGH ACCELERATION STRESS, by William C. Sipple and B. David Polis. Rept. no. 1 on Proj. NM 11 02 12. 15. 17 June 59, 13p. 2 refs. NADC-MA-5906.
Order from LC mi$2. 40, ph$3. 30 PB 143 430

By means of a transistor amplifier mounted before the slip rings of an animal centrifuge it was possible to obtain recordings of the "EKG" of rats under acceleration stress. With this information a physiological end point for the tolerance of the rat to 20 G (positive acceleration) was defined as the time to reduce the heart rate of the animal from an initial state ranging from seven to nine beats per second to a final moribund state of 2 beats per second. The instrumentation and techniques employed permit the option of recovering the animal alive after approaching the limit of tolerance to acceleration.

Duke U. School of Medicine, Durham, N. C.
FINAL REPORT, by James V. Warren. Rept. on Contracts AF 18(600)1542 and 41(657)208. [1959] 11p. 15 refs. AFOSR-TR-59-102.
Order from LC mi$2. 40, ph$3. 30 PB 143 505

A comprehensive study of the nature of vasodepressor syncope (the common faint) has been undertaken. A critical review of the available information regarding this phenomenon has been carried out. In addition, experimental studies aimed primarily at the circulatory nature of vasodepressor syncope and, in particular, dealing with the precipitating and predisposing factors, has lead to observations on the effects of various humoral substances such as norepinephrine on the vascular system, as well as the effect of drugs such as atropine and isoproterenol. Additional observations were made on the nature of abnormal heart sounds in a variety of clinical conditions.

Kansas U., Lawrence.
STUDIES ON THE PATHOGENESIS AND IMMUNITY OF TULAREMIA, by Cora M. Downs. Final rept. for 1 July 51-21 Dec 58 on Contract N6onr-26007. [1958] 17p. 18 refs.
Order from LC mi$2. 40, ph$3. 30 PB 143 616

An extensive study of smooth and non-smooth variants and their antigenicity was undertaken and showed that the non-smooth avirulent variants and the smooth avirulent variants were lacking in immunegenicity and in the ability to incite antibodies. Immune Rabbit serum even with high agglutinative powers was not bactericidal. An extensive test of vaccines prepared from cultures of Bacterium tularense and killed by various chemical and physical means showed that they produced what seemed to be a good degree of immunity provided the mice were challenged with the partially virulent strain 425. If challenged with the virulent Schu(Sm_4) strain no or very little protection was evident. The work reported on heat stable extracts from tissue and cultures indicated that a great part of the antigenic properties of the organism resided in these extracts. An intensive study was made of the culture extracts and mouse tissue extracts. Methanol precipitation was found to be effective in purifying the extracts and since 1956 an intensive study has been made using chemical and physical methods.

Naval School of Aviation Medicine, Pensacola, Fla.
CARDIOVASCULAR PROBLEMS IN AVIATION MEDICINE: EVALUATION OF HEART MURMURS, by John M. Packard and Ashton Graybiel. 24 May 51, 30p. 5 refs. Proj. NM 001 059. 06. 05.
Order from LC mi$2. 70, ph$4. 80 PB 143 811

The importance of proper interpretation of a heart murmur by the flight surgeon is emphasized. The elicitation of the physical characteristics of a murmur, and the evaluation of the murmur based on these characteristics, is described in detail. Brief analysis is made of 1090 service personnel seen in consultation at the cardiovascular laboratory at School of Aviation Medicine, Pensacola, Florida. About one fifth (192 cases) were referred for the evaluation of a murmur. These cases may be divided into four groups: one group of 15 cases in which extra cardiac sounds were mistaken for murmurs, a second group of 33 cases in which the murmurs were clearly related to some type of underlying heart disease, a

or mixed-type hearing loss, the remaining 87 percent being perceptive-type hearing loss; that 35 out of 75 individuals in Class B and Class C groups expressed a preference for an ear and of these 35 individuals, 25 chose the better ear correctly.

Radiobiological Lab., U. of Texas, Austin.
ACUTE EFFECTS OF GAMMA RADIATION IN PRIMATES, by Ralph G. Allen, Frank A. Brown and others. Apr 59, 24p. 8 refs. AFSAM rept. 59-41.
Order from LC mi$2. 70, ph$4. 80 PB 143 740

In an excellent paper on the acute radiation syndrome in man, Gerstner described a dose - survival time curve containing three "plateaus" or dose-independent regions. This curve, reproduced in figure 1, has been estimated for man from clinical data and animal experiments. These "plateau regions" are ascribed to three different pathogenic mechanisms - death being caused in the low-dose region by hematopoietic depression, in the mid-dose region by gastrointestinal denudation, and in the high-dose region by a failure of the central nervous system.

Texas U., Austin.
RELATIVE HEARING LEVELS AND TYPES OF HEARING LOSS AMONG FOUR SELECTED GROUPS OF AIR FORCE PERSONNEL, by Lennart L. Kopra, Duilio T. Pedrini, and Roger W. Fullington. Apr 59, 12p. 9 refs. AFSAM rept. 59-51.
Order from LC mi$2. 40, ph$3. 30 PB 143 371

Results showed: good agreement between median and mean thresholds at almost all test frequencies; no significant differences between right and left ears within groups; that the Class Ann and A median and mean thresholds were within a few decibels of the American Standard reference normal; that the Class B group deviated from the Class A groups only at 3000, 4000, and 6000 cps; that, with the exception of Class B at 4000 and 6000 cps, the Class C group was significantly different from the other groups at all test frequencies; that approximately 13 percent of Class B and Class C groups had either conductive third group of 12 cases in whom a definite decision could not be reached and a fourth group of 132 cases in whom an innocent murmur was heard. In five persons who were referred for reasons other than the evaluation of a murmur pathological murmurs were heard which had been overlooked by the referring physician. These murmurs were all diastolic in time. A final analysis is made of the systolic murmurs which were heard. The innocence of most pulmonic systolic murmurs is stressed. The disposition of service personnel with a faint apical systolic murmur, which is the most difficult murmur to evaluate, is discussed.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
EXCRETION AND LOCALIZATION IN THE RAT OF C^{14} ADMINISTERED AS 3,4-BIS(p-DIETHYLAMINOETHOXYPHENYL)-3-HEXENE DIMETHIODIDE (879C) by J. Henry Willis and Sarah C. Kalser. Technical rept. for 1 Apr 55-30 Nov 57 on Pharmacology of Toxic Compounds. Sep 58, 21p. 18 refs. CWLR 2243; AD-205 857
Order from LC mi$2.70, ph$4.80 PB 139 142

The rat excretes, within a mean of 4.9 hours, a mean of 7.3 per cent of C^{14} injected as 879C. Fecal excretion accounts for probably some 30 per cent of the administered C^{14}. Kidney, liver, small intestine, lung, spleen, heart and adrenal glands are particularly active in taking up C^{14}; low in uptake are the brain and spinal cord. Blood is almost free of C^{14} one and three-fourths hours after the intravenous injection of labeled 879C. Respiratory muscles absorb more C^{14} of 879C than limb muscles. Both liver and kidney may alter the molecule.

Army Chemical [Warfare] Labs., Army Chemical Center, Md.
THE INFLUENCE OF SPONTANEOUS PULMONARY DISEASE IN A TOXICO-PATHOLOGICAL STUDY OF CHRONIC DIBORANE TOXICITY IN RATS, by A. J. McAdams. May 55, 15p. Medical Labs. Research rept. no. 362.
Order from LC mi$2.40, ph$3.30 PB 143 539

Rats at different ages were exposed to diborane at 6 ppm for six weeks. Detailed examination of the lungs of these animals revealed an incidence of chronic murine pneumonia in both the control and exposure groups precluding any conclusion concerning the possible toxicity of diborane to the lung at this concentration. The problem of evaluation of pathological changes of an experimental nature from those of spontaneous origin is emphasized.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE INTRAVENOUS TOXICITY OF FIVE OXIMES IN DOGS, by James W. Crook and Paul Cresthull. July 59, 20p. 13 refs. CWLR-2284; AD-220 253.
Order from LC mi$2.40, ph$3.30 PB 144 037

The intravenous LD50's of five oximes were determined in dogs. The prominent toxic signs observed in the dogs were staggering, collapse, convulsions, flaccid paralysis, and death. Flaccid paralysis occurred less frequently with 2-PAM than with the other compounds. It is concluded that 2-PAM is the least toxic of the five oximes studied. There is a significant difference between the toxicities of EA 1814 and EA 1813 using 90% confidence limits. EA 1814 is approximately three times more toxic to dogs than 2-PAM while EA 1813 is approximately five times more toxic than 2-PAM. There is no significant difference between the toxicities of EA 1941 and EA 1811 using 95% confidence limits. These two oximes are approximately 9 and 13 times, respectively, more toxic to dogs than 2-PAM.

Army Chemical Warfare Labs., Army Chemical Center, Md.
TOXIC CHEMICAL WARFARE AGENTS: REPORT OF SYMPOSIUM IX, VOLUME I, CONDUCTED BY U. S. ARMY CHEMICAL WARFARE LABS. 25, 26, 27 JUNE 1958. May 59, 71p. 22 refs. CWL Special Pub. 3.
Order from LC mi$4.50, ph$12.30 PB 143 503

The following papers are reported: Structure and chemistry of viruses; Chemical model of drug action; A new approach to the study of neuromuscular transmission; Kinetics of enzyme catalyzed reactions in the presence of inhibitors; Natural asymmetry and optical isomerism; The structure of enzymes; Incapacitation by anesthetic agents; The pharmacology of psychochemical compounds; The psychological effects of psychochemical compounds; Isolation and properties of certain marine toxics; Snake vemons; Bacterial toxins; Mechanisms of incapacitation; and Screening procedures for incapacitating compounds.

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
TOXICITY OF CERTAIN ENGINE OILS, HYDRAULIC FLUIDS, AND BASE OILS FOR THE COMPOUNDING OF BOTH HYDRAULIC FLUIDS AND ENGINE OILS, by Colborn T. Blaisdell. Mar 54, declassified 14 Feb 58. 23p. 5 refs. Medical Labs. Research rept. no. 256.
Order from LC mi$2.70, ph$4.80 PB 144 207

The intrinsic toxicities of these compounds in rabbits and rats are relatively low as manifested by intravenous LD50's between 0.05 cc./kg. and 1.5 cc./kg. The hazard to humans incurred by swallowing these compounds would appear almost negligible. The hazard from an accidental splash in the eye of one of these compounds appears to be slight. The chief hazard in-

volved in the use of these compounds would appear to necessitate continued cutaneous exposure. The worst of them, notably compounds No. 4, 7, 9, 10, and 12, could cause some erythema, and hardening and cracking of the skin on prolonged contact, however, all of these changes appear reversible and will probably disappear if exposure to the compounds is discontinued.

Institute for Experimental Cancer Research, U. of Heidelberg (West Germany)
ACTION OF KINETIN AND OTHER AMINO PURINE DERIVATIVES ON CELLS IN TISSUE CULTURE, by Hans Lettre. Final technical rept. no. 1, 29 Apr 57-9 May 59, on Contract DA 91-508-EUC-188. [1959] 36p. 29 refs.
Order from LC mi$3.00, ph$6.30 PB 143 410

The compounds investigated are listed under the numbers 1 - 83. Though the field of purine derivatives had been studied very intensively in search for chemotherapeutical agents, our observations show that it is still an unexplored field. The compounds are active only in the system of tissue culture. Starting from out present results one can expect to find more compounds with this quality. On the other hand it must be stated that only a small percentage of all compounds has an activity at all and even a smaller percentage has this differential activity. Future work have not been shown to be contributing factors in the etiology of motion-induced emesis.

Radiobiological Lab., U. of Texas, Austin.
A FURTHER STUDY OF THE INTERACTION OF ELECTROCONVULSIVE SHOCK WITH CHLORPROMAZINE AND RESERPINE, by Claude B. Elam, Edward C. Wortz, and W. Lynn Brown. June 59, 7p. 3 refs. AFSAM rept. 58-144.
Order from LC mi$1.80, ph$1.80 PB 143 384

Five dose levels for each of the drugs were examined and compared with appropriate control conditions. These effects were studied with the subjects in an atmosphere of 95 percent O_2 + 5 percent CO_2 as well as under normal atmospheric conditions. A synergic relationship is obtained when electroconvulsive shock is administered in conjunction with either reserpine or chlorpromazine. When an atmosphere of 95 percent O_2 + 5 percent CO_2 is made available to an animal immediately prior to and during electroconvulsive shock procedures, there is a significant reduction in the probability of death.

School of Aviation Medicine, Randolph AFB, Tex.
THE EFFICACY OF TRILAFON IN POTENTIATING BONAMINE MOTION SICKNESS PROPHYLAXIS IN DOGS, by Howard R. Unger and Lawrence J. Milch. June 59, 5p. 15 refs. Rept. 59-78; AD-226 474.
Order from LC mi$1.80, ph$1.80 PB 143 581

Susceptible animals were randomly placed in three treatment groups — namely, placebo, bonamine^R, and the combination of bonamine^R with trilafon^R. Bonamine^R and the combination of bonamine^R with trilafon^R exhibited a protective effect against swing-induced emesis. Trilafon^R, a potent tranquilizer, has no protective effect when used along and in combination with bonamine^R affords a degree of protection which is no greater than the effect shown by bonamine^R alone. It is therefore concluded (a) that the action of trilafon^R does not contribute to the protection afforded by bonamine^R against swing-induced vestibular stimulation and, there, (b) that stimuli arising from those brain centers affected by trilafon^R should be done in the direction of (1) derivatives with a direct substitution of carbon atomes to C-6 of the purine system; (2) derivatives combining two substituted amino groups in the purine system, and (3) ribotides of compounds found to be active. Further, the study of the mechanism of the action of these compounds on cells seems to be important. Up to now work in this direction has been done on the morphological basis, but it should be extended to the biochemical events causing the morphological changes.

Radiobiology

Radiobiological Lab., U. of Texas, Austin.
RADIATION-INDUCED CENTRAL NERVOUS SYSTEM DEATH: A STUDY OF THE PATHOLOGIC FINDINGS IN MONKEYS IRRADIATED WITH MASSIVE DOSES OF COBALT-60 (GAMMA) RADIATION, by Stephen G. Wilson, Jr. Apr 59, 19p. 11 refs. AFSAM rept. 59-58.
Order from LC mi$2.40, ph$5.30 PB 143 679

This report presents circumstantial evidence indicating that gastrointestinal damage is also an important part of the syndrome of "radiation-induced central nervous system death." Also, the observed central nervous system changes are compared to those described by other authors. The concept of "leukocyte devitalization" is introduced.

Radiobiological Lab., U. of Texas, Austin.
SOME EFFECTS OF NUCLEAR RADIATION EXPOSURE ON PRELIMINARY WGTA TRAINING PERFORMANCE OF RHESUS MONKEYS, by A. A. McDowell, W. Lynn Brown, and James E. Wicker. May 59, 5p. 13 refs. AFSAM rept. 59-53.
Order from LC mi$1.80, ph$1.80 PB 143 741

Wisconsin General Test Apparatus (WGTA). The investigation, in addition, studies the same animals with respect to simple object-quality discrimination learning unconfounded by previous training of a similar nature.

Oregon State Board of Health, Portland.
A REVIEW OF SOVIET RESEARCH ON THE CENTRAL NERVOUS SYSTEM EFFECTS OF IONIZING RADIATIONS, by Walter R. Stahl. [1958] 49p. 73 refs.
Order from LC mi$3.39, ph$7.80 PB 143 558

Brief reviews are presented of a number of Soviet scientific papers on the CNS effects of radiation, most of which are not available in translation. The Soviets consider the CNS as being highly sensitive to radiation and have reported work implicating it at general levels of a few or tens of roentgens, several hundred r and 500-1000 r. It appears presently impossible to reach a final conclusion on the question of a threshold.

USAF Radiation Lab., U. of Chicago, Ill.
EFFECTS OF BETA-AMINOETHYLISOTHIQUREA (AET) ON ENZYMES OF ANIMAL TISSUES, by Gerald R. Zins, Ann B. Raymund, and Kenneth P. DuBois. Apr 59, 15p. 31 refs. AFSAM rept. 59-34.
Order from LC mi$2.40, ph$3.30 PB 143 380

The effects of the radioprotective compound β-aminoethylisothiourea (AET) on sulfhydryl enzymes of mammalian tissues have been determined, in an effort to obtain information regarding the biologic activity of the drug. A number of enzyme systems involved in oxidative carbohydrate metabolism of rat tissues were inhibited in vitro by concentration of AET within the predicted in vivo range following sublethal doses. The results of this study demonstrate the feasibility of a theory of radioprotective mechanisms involving the formation of radioresistant complexes between the protective agent and important biologic sulfhydryl groups.

Washington U., Seattle. School of Medicine.
THE COMBINED EFFECTS OF IONIZING RADIATION AND HIGH TEMPERATURE ON THE LONGEVITY OF THE WHITE RAT, by L. D. Carlson and B. H. Jackson. Mar 59, 12p. 17 refs. AFSAM rept. 58-156.
Order from LC mi$2.40, ph$3.30 PB 143 744

Male Sprague-Dawley rats, individually caged, were exposed to low level irradiation from a Co^{60} source for 16 hours a day. The animals were selected by weight and growth rate, and divided into eight groups of 22 rats. Four groups were kept at $28^{\circ} \pm 1^{\circ}$ C. and were exposed to 0.29, 0.64, 2.60, and 4.18 r/day during the irradiation period, which lasted from 4 to 16 months of age. The other groups were kept at $35^{\circ} \pm 1^{\circ}$ C. during the period of irradiation which lasted from 4 to 16 months of age, and were exposed to 0.28, 0.60, 2.57, and 3.96 r/day. At 35° C. the ET_{50} for 0.29 r/day was 310; 0.64 r/day was 490; 2.60 r/day was 540; and 4.18 r/day was 510. At 28° C. the ET_{50} for 0.28 r/day was 493; 0.60 r/day was 510; 2.57 r/day was 810; and 3.96 r/day was 590. With the exception of the relation between 0.60 and 0.28 r/day, the data are statistically significant at the 5 percent level. From a previous experiment at 26° C. the ET_{50} for 0 r/day was 445 and 0.8 r/day was 585. It is suggested that the effects of ionizing irradiation interact with the effects of environment in intluencing longevity.

Zoology

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE CHEMISTRY OF FISH BLOOD, A BIBLIOGRAPHY, by Joseph B. Hunn. May 59, 20p. 194 refs. CWL Special Pub. 2-22.
Order from LC mi$2.40, ph$3.30 PB 143 536

The present bibliography attempts to bring together most of the important papers on piscine blood chemistry. It is possible that some important material has been omitted. It is hoped that these references will be a help and stimulus to further basic research in fish physiology.

Narragansett Marine Lab., U. of Rhode Island, Kingston.
AN OUTLINE OF SOUNDS PRODUCED BY FISHES IN ATLANTIC COASTAL WATERS, SOUND MEASUREMENTS AND ECOLOGICAL NOTES, by Marie Poland Fish. Technical rept. no. 12 on Biological Oceanography Project, Contract Nonr-396(02). 28 Oct 58, 32p. 1 ref. Reference no. 58-8.
Order from LC mi$3.00, ph$6.30 PB 143 702

Available fishes in representative faunal areas are subjected to a series of carefully controlled situations and stimulations as a means of evaluating their sound-making ability. Positive results are analyzed for amplitude, frequency range and principal frequency components, and the recordings of each species assembled in the form of a reference file. The tables present data on 24 species of North Atlantic coastal fishes investigated at the Narragansett Marine Laboratory and 19 species of typical subtropical Atlantic species auditioned at the Bermuda Government Aquarium and the Bermuda Biological Station for Research. Geographical, seasonal and vertical distribution are included since these data are essential in predicting the occurrence of the sounds of each species. Where available, breeding details are added inasmuch as sound production among many fishes is synchronized with this cycle.

CHEMISTRY

Illinois Inst. of Tech., Chicago.
THE CHEMISTRY OF SILICON AND GERMANIUM HYDRIDES, by Sei Sujishi. Final rept. for 1 Feb 58-31 Aug 59 on Contract AF 49(638)276. 18 Aug 59, 117p. 8 refs. AFOSR-TR-59-137.
Order from LC mi$6.00, ph$18.30 PB 143 572

In order to obtain further data regarding the relative basicities of methyl- and silylamines, the reactions of silyldimethylamine, methyldisilylamine, and trisilylamine were studied with the strong Lewis acids diborane, trimethyl-aluminum, and trimethylgallium. A study of the reactions between trisilylamine, disiloxane, and silyl fluoride with trimethylgallium under comparable conditions indicated that at -78.5° the one to one complex, disiloxane-trimethylgallium, exists. This suggests the relative basicities for these

compounds to be $(SiH_3)_3N < (SiH_3)_2O > SiH_3F$. This order has been interpreted in terms of silicon-nitrogen and silicon-oxygen π bonding.

Metal Hydrides, Inc., Beverly, Mass.
THE PREPARATION OF TRANSISTOR GRADE SILICON FROM SILANE OR ANALOGOUS COMPOUNDS, by Charles H. Lewis, Mario B. Giusto, and Sidney Johnson. Final rept. on Contract AF 19(604)3464. 30 Oct 59, 36p. 10 refs. AFCRC-TR-59-354.
Order from OTS $1.00 PB 161 261

The preparation, purification and thermal decomposition of silane have been investigated for the purpose of preparing transistor grade silicon. Yields of 94 to 100% silicane are obtained by the reduction of silicon tetrachloride with various hydrides. The reactivity of silane with substances proposed as purifying agents has been studied. Variables in the thermal decomposition of silane have been evaluated with particular emphasis on purity of elemental silicon plus efficiency of dissociation and deposition rate. Silane has been dissociated on an inductively heated single crystal substrate, producing silicon deposits large enough for single crystal evaluation and neutron activation analysis. A process has been developed whereby silicon can be made continuously from silane using induction heating.

Wisconsin U., Madison.
THE STUDY OF PYRIDINIUM IODIDE CHARGE-TRANSFER BANDS, by Edward M. Kosower. Rept. on Contract AF 49(638)282. 29 Sep 59, 10p. 20 refs. AFOSR-TN-59-812; AD 226 711
Order from LC mi$1.80, ph$1.80 PB 143 641

The general nature of pyridinium iodide light absorption is discussed. It is pointed out that the high sensitivity of this electronic transition to internal and external influences makes detailed study very rewarding with respect to information on electrical, steric, and solvent effects.

Inorganic Chemistry

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
REVISION OF FEDERAL SPECIFICATION P-S-751 STEAM CLEANING COMPOUND, by A. Mankowich. 9 Sep 59, 8p. 4 refs. Rept. no. CCL-82.
Order from LC mi$1.80, ph$1.80 PB 143 575

Federal Specification P-S-751 was revised to include the latest improvements in technology with the principal changes being in the areas of: (1) Deletion of percentage phosphates requirement. (2) Prohibition of carbonates. (3) Clarification of aluminum corrosion test. (4) Modification of solubility test. (5) Modification of free caustic test. (6) Addition of full scale, caking-storage test. (7) Recommendation of procurement in air-tight metal containers. Other possibilities such as the use of anhydrous salts and borates were explored.

Institute for the Study of Metals, U. of Chicago, Ill.
THERMAL AND MAGNETIC PROPERTIES OF $MnBr_2$ AT LOW TEMPERATURES, by J. W. Stout, Wayne B. Hadley and C. L. Brandt. Technical rept. no. 4 on Contract N6ori-02051. Nov 58, 7p. 6 refs.
Order from LC mi$1.80, ph$1.80 PB 143 420

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME PROPERTIES OF NITRIC ACID, NITROGEN DIOXIDE, NITRIC OXIDE, WATER, AND THEIR MIXTURES, by B. H. Sage. Rept. on Contract DA 04-495-ORD-18. 15 Oct 57, 157p. 104 refs. Rept. no. 20-107; AD-203 044.
Order from LC mi$7.50, ph$24.30 PB 143 889

A number of the properties of nitric acid, the oxides of nitrogen, and their mixtures with water have been reviewed, and a summary account of the results is given in a systematic form, utilizing the units of measurement commonly encountered in industry. Information concerning the volumetric and phase behavior of the components, their binary mixtures, and the nitric acid-nitrogen dioxide-water ternary system is presented for both physical and physicochemical equilibrium, as well as for the approach to physicochemical equilibrium while at physical equilibrium. Data pertaining to the electrical conductance and optical absorbance of some of these systems are set forth, together with transport properties, such as the viscosity of the liquid phase. In addition, information related to the volumetric and phase behavior of the nitrogen dioxide-nitric oxide system and to the behavior of pure nitric oxide has been included.

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by W. C. Schumb and C. N. Satterfield. Quarterly periodic status rept. on Contract Nonr-1841(11). 31 Dec 58, 25p.
Order from LC mi$2.70, ph$4.80 PB 143 934

Contents:
Stability studies
Heterogeneous catalysis in liquid hydrogen peroxide
Burning velocities of the H_2O_2 decomposition flame at low pressures
Heterogeneous catalysis of hydrogen peroxide vapor
Hydrogen peroxide from the partial oxidation of propane in a porous-walled reactor
Summary of reports
(See also PB 142 086)

Organic Chemistry

Central Inst. for Industrial Research (Norway).
THE STRUCTURE OF LINEAR POLYMERS: LOWER n-HYDROCARBONS, by Nico Norman and Hans Mathisen. Final technical rept. no. 1, 1 July 58-30 June 59, on Contract DA 91-508-EUC-377. July 59, 98p. 74 refs.
Order from LC mi$5.40, ph$15.30 PB 143 454

The immediate purpose of the present work is to study and to compare the structure of the lower normal paraffins in the gaseous, liquid, and solid state. As

proper substances are chosen n-pentane, n-hexane; n-heptane, and n-octane. The second and perhaps - most important purpose of the started investigations is to gain experience as to the usefulness of the electron- and different X-ray diffraction techniques for the study of linear polymers. For most high polymers it is impossible to grow good enough crystals for single crystal X-ray diffraction work. It is hoped that a comparison of the results obtained for the relatively simple n-paraffins will give an indication of the structural information one may expect to get from electron and X-ray diffraction studies on these more complicated compounds.

Edinburgh U. (Gt. Brit.)
REACTIONS RELATED TO OXIDATION, by W. E. Falconer, J. H. Knox, and A. F. Trotman-Dickenson. Final technical rept. no. 1, Sep 58-Sep 59, on Contract DA 91-508-EUC-372. 28 Sep 59, 14p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 143 898

The competitive oxidations of cyclopropane-ethane and methane-ethane mixtures have been studied, and the relative rates of disappearance of reactants have been determined. The experimental technique is described. The oxidation of ethane alone has been studied and the products analyzed for methane and ethylene. Suggestions for future research have been proposed.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DILUTE SOLUTION PROPERTIES OF POLY-(N-LAURYL METHACRYLATE), by Suresh N. Chinai and Rudolph A. Guzzi. Oct 59, 34p. 12 refs. Technical rept. 2649.
Order from LC mi$3.00, ph$6.30 PB 142 487

Poly-(n-lauryl methacrylate) was prepared by the emulsion technique and fractionally precipitated by using benzene as the solvent and isopropanol as the precipitant to yield nine sharp fractions. The weight-average molecular weight dependence of the intrinsic viscosity $[\eta]$, and the root mean square end-to-end distance in an ideal (poor) solvent (isopropyl acetate at 13°C) and in a nonideal (good) solvent (n-butyl acetate at 23°C) were established. The relationship between the osmotic second virial coefficient A_2 and the weight-average molecular weight M_w in the nonideal solvent (n-butyl acetate at 23°C) was also determined. The effect of the size of the pendent group on the degree of chain extension is evident in the following order of decreasing chain extension:
PLMA > PHMA > POMA > PBMA > PEMA > PMMA.
Huggins constant k' was calculated for poly-(n-lauryl methacrylate) in the ideal and nonideal solvent. The molecular expansion factor α and the Flory universal constant ϕ were calculated for poly-(n-lauryl methacrylate).

Naval Research Lab., Washington, D. C.
SURFACE ACTIVITY OF FLUORINATED ORGANIC COMPOUNDS AT ORGANIC-LIQUID/AIR INTERFACES. PART II. SURFACE TENSION VS CONCENTRATION CURVES, ADSORPTION ISOTHERMS AND FORCE-AREA ISOTHERMS FOR PARTIALLY FLUORINATED CARBOXYLIC ESTERS, by N. L. Jarvis and W. A. Zisman. Interim rept. 8 Oct 59, 19p. 13 refs. NRL rept. 5364.
Order from OTS $0.50 PB 151 808

This investigation was undertaken to study the ability of a series of partially fluorinated carboxylic esters to depress the surface tension of a group of pure organic liquids. The surface activity of these solutes in the different solvents was shown to vary with the hydrocarbon content, fluorocarbon content, and the number and position of associating groups in the solute. The balance between these organophilic and organophobic groups in the solute molecules which gave maximum surface tension depression varied with the surface tension of the solvent and the solubility of the solute in it. In this report surface tension vs concentration curves, adsorption vs concentration isotherms, and graphs of monolayer film pressure vs area per molecule of adsorbed solute are given for each fluorochemical in the various organic solvents. Theoretical calculations from these data give the extent of adsorption and explain the orientation and packing of the molecules adsorbed at the interface of liquid and air. A discussion is given of the effect of the organophobic and organophilic constituents of the solute molecules on the extent of adsorption and on the tendency to associate with the various solvents.

Naval Research Lab., Washington, D. C.
TAUTOMERISM IN PHOSPHORUS CHEMISTRY. PART III. HYDROGEN ISOTOPE EXCHANGE IN PHENYLPHOSPHINIC ACID AND ITS ANION, by R. B. Fox. Final rept. 20 Oct 59, 13p. 22 refs. NRL rept. 5393.
Order from LC mi$2.40, ph$3.30 PB 142 450

A study has been made of prototropy in the P(O)H system as found in phenylphosphinic acid. Hydrogen isotope exchange has been used as a measure of the extent to which prototropy may occur in such phosphorus derivatives. In aqueous solutions, the exchange has been found to be both acid- and base-catalyzed, with a prototropic equilibrium probably governing the rate of the acid-catalyzed reaction. Exchange takes place to only a negligible extent in buffered neutral solutions over periods up to six weeks, which makes unlikely a termolecular attack as a significant factor in the mechanism of the reaction. A comparison of exchange rates with those found in

aqueous acetone solutions indicates that the proportions of enol in both systems is of the same order of magnitude. (See also PB 140 391)

Pennsylvania U., Philadelphia.
THE INTERACTION OF DIBORANE WITH SILYL CYANIDES. Technical rept. no. 3 on Contract Nonr-551(21). 22 Oct 58, 19p. 21 refs.
Order from LC mi$2.40, ph$3.30 PB 143 047

The interaction of diborane with silyl cyanide or trimethylsilyl cyanide results in the formation of the adducts $H_3SiCN.BH_3$ and $(CH_3)_3SiCN.BH_3$, respectively. When these are heated the corresponding silyl hydrides are eliminated and the polymeric compound $(BH_2CN)_x$ is formed.

Pennsylvania U., Philadelphia.
THE INTERACTION OF ALKYL BORINES WITH TRIMETHYLSILYL CYANIDE. Technical rept. no. 5 on Contract Nonr-551(21). 15 Oct 58, 14p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 143 219

The interaction of $(n\text{-}C_4H_9)_2BCl$ with $(CH_3)_3SiCN$ results in the formation of polymeric $(n\text{-}C_4H_9)_2BCN$, which is a viscous liquid. This substance reacts with sodium in liquid ammonia to produce monomeric $(n\text{-}C_4H_9)_2BNH_2$. $(CH_3)_3B$ and $(CH_3)_3SiCN$ react to produce substances which spontaneously polymerize or condense.

Wisconsin U., Madison.
PYRIDINIUM COMPLEXES. I. THE SIGNIFICANCE OF THE SECOND CHARGE-TRANSFER BAND OF PYRIDINUM IODIDES, by Edward M. Kosower. Rept. on Contract AF 49(638)282. 29 Sep 59, 21p. 28 refs. AFOSR-TN-59-813.
Order from LC mi$2.70, ph$4.80 PB 143 589

In a previous paper, the existence of a second pyridinium iodide charge-transfer absorption band was mentioned. The present paper shows how the existence of the second band is in accord with the current model for pyridinium iodide charge-transfer transitions.

Wisconsin U., Madison.
PYRIDINIUM COMPLEXES. III. CHARGE-TRANSFER BAND OF POLYALKYLPYRIDINIUM IODIDES, by Edward M. Kosower. Rept. on Contract AF 49(638)282. 29 Sep 59, 40p. 59 refs. AFOSR-TN-59-811.
Order from LC mi$3.00, ph$6.30 PB 143 599

A study of the first (long wavelength) charge-transfer band of twenty different alkylpyridinium iodides under carefully standardized conditions has established that (1) increasing the number of methyl groups raises the transition energy (2) changing a methyl group from the 3- to the 2- to the 4-position increases the transition energy (3) varying the nature of the alkyl group from methyl to t-butyl on the 4-position has virtually no effect upon the transition energy and (4) the solvent sensitivity of 1-methylpyridinium iodide is appreciably greater than that of 1-ethyl-4-carbomethoxypyridinium iodide, as might have been expected on the basis of a previously proposed model. (See also PB 143 589)

Physical Chemistry

Aeronutronic Systems, Inc., Glendale, Calif.
EMISSIVITY OF THE 4.3 MICRON BAND OF CARBON DIOXIDE, by Gilbert N. Plass. Scientific rept. no. 2 on Contract AF 19(604)2166. 31 July 58, 39p. 13 refs. ASI pub. no. U-238; AFCRC TN-58-604.
Order from LC mi$3.00, ph$6.30 PB 138 860

The spectral emissivity of carbon dioxide in the 4 to 5 micron region is calculated as a function of temperature, pressure and amount of emitting gas. It is assumed that the electric moment matrix element can be calculated by using the harmonic oscillator approximation to represent the vibrational states. The emission of the isotopic molecule $C^{13}O_2$ is taken into account. The choice of a proper model to represent the CO_2 emission is discussed.

Amherst Coll., Mass.
AN ATTEMPT TO ESTABLISH THE EXISTENCE OF AND POSSIBLY THE NATURE OF THE COMPOUNDS $Na_2N_2O_x$ ($x = 3, 4, 5$ or 6) by Earle S. Scott. Final summary rept. on Contract DA 19-059-ORD-2627. 25 July 59, 11p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 143 484

The study of the reaction of sodium hyponitrite, silver hyponitrite and sodium nitrohydroxylamate with liquid dinitrogen tetroxide has yielded no evidence for the existence of anions of the type N_2O_x. X-ray diffraction patterns and chemical analyses of the solid products obtained indicate that the nitrate is in each case the predominant product and that, in the case of the two sodium salts, an appreciable but variable quantity of sodium nitrite is formed. The product NaNO obtained from the reaction of nitric oxide with a solution of sodium in liquid ammonia has been prepared and caused to react with dinitrogen tetroxide in carbon tetrachloride at 0° C. Attempts were also made to prepare a third compound reported to be NaNO by the direct reaction of molten sodium with nitric oxide. To date, the conditions required to get a reproducible product have not been established.

Barnes Engineering Co., Stamford, Conn.
SPECTRALLY SELECTIVE INFRARED DETECTOR DEVELOPMENT, by Andrew C. Rudomanski. Final rept. for June 57-May 58 on Contract DA 18-108-cml-6386. 11 June 58, 41p.
Order from LC mi$3.30, ph$7.80 PB 143 340

Spectrally Selective Thermistor Detectors have been developed to be incorporated in a simplified gas alarm system. Detectors are responsive in narrow spectral intervals matched to generic absorption bands, thus eliminating the need of dispersive optics. Two detectors have been made, one sensitive at 9.8 μ and the other to intervals above and below 9.8 μ and can thus be used in a standard two-channel radiometer.

Battelle Memorial Inst., Columbus, Ohio.
PARTICLE-SIZE DISTRIBUTION AND CONCENTRATION OF AEROSOLS, by J. M. Pilcher, R. I. Mitchell, and R. E. Thomas. Annual rept. no. 2 for 1 Apr 53-31 Mar 54 on Contract DA 18-064-cml-1914. 31 Mar 54, declassified 26 Apr 56, 75p.
Order from LC mi$4.50, ph$12.30 PB 143 365

The performance of the Battelle No. 3 cascade impactor has been substantially improved as an instrument for determining the particle-size distribution and concentration of aerosols. A fluorometric method

of analysis, to determine the amount of aerosol particles impacted on each stage, has been developed as a substitute for the more tedious gravimetric analysis using microbalances. Analysis of variance of particle-size data obtained by gravimetric methods indicates that with suitable precautions, the procedure may be brought under statistical control. The reproducibility of weighing on microbalances is about ±9 micrograms at the five per cent level. Studies related to particle-size analysis such as (1) the performance of the Casella impactor, (2) isokinetic sampling, (3) equilibrium evaporation of SM slurry, and (4) control of BG contamination are reported. Considerable additional research is required to perfect the impactor method of particle-size analysis. Eleven recommendations are made herein.

Florida State U., Tallahassee.
ORGANIC REACTIONS OCCURRING IN OR ON MICELLES. I. KINETIC STUDIES OF THE ALKALINE FADING OF TRIPHENYLMETHANE DYES AND SULFONPHTHALEIN INDICATORS IN THE PRESENCE OF DETERGENT SALTS, by E. F. J. Duynstee and E. Grunwald. Technical rept. on Contract Nonr-988(02). 2 Dec 58, 22p. 10 refs. AD-207 095.
Order from LC mi$2.70, ph$4.80 PB 143 611

Kinetic studies were made of the fading in alkaline solution of triphenylmethane dyes and of sulfonphthalein indicators in the presence of micelle-forming salts.

Fulmer Research Inst., Ltd., (Gt. Brit.).
STUDIES AND EXPERIMENTAL INVESTIGATIONS IN THE FIELD OF MEASUREMENTS OF THE HEAT OF FREE ENERGY OF FORMATION OF THE CHLORIDES AND BROMIDES OF NIOBIUM AND TANTALUM, by P. Gross, C. Hayman and others. Final technical rept. for 1 June 57-31 May 59 on Contract DA 91-508-euc-176. 23 June 59, 46p. 12 refs. R. 115/5/23.
Order from LC mi$3.30, ph$7.80 PB 143 115

The standard heat of formation established for each compound is as follows:-
Niobium pentachloride ΔH^{o}_{298} = -190.6 kcal/mole
Niobium pentabromide ΔH^{o}_{298} = -132.85 kcal/mole
Tantalum pentachloride ΔH^{o}_{298} = -205.52 kcal/mole
Tantalum pentabromide ΔH^{o}_{298} = -142.96 kcal/mole
The total error in these values is estimated to be not greater than 0.3 kcal/mole for the pentachlorides, and not greater than 0.4 kcal/mole for the pentabromides.

General Electric Research Lab., Schenectady, N. Y.
PREPARATION OF DIBORANE BY REACTION OF LITHIUM HYDRIDE AND BORON CHLORIDE, by J. R. Elliott and G. F. Roedel. Rept. on Project Hermes, Contract [DA 30-115-ORD-23]. 18 Feb 48, declassified 11 Aug 49, 11p. 1 ref. Rept. no. 55254.
Order from LC mi$2.40, ph$3.30 PB 144 264

Boron chloride gas passed into a slurry of lithium hydride in ethyl ether yields diborane of high purity.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL VERIFICATION OF THEORETICAL RELATIONS BETWEEN TOTAL GAS ABSORPTIVES AND TOTAL GAS EMISSIVITIES FOR CO, by U. P. Oppenheim. Technical rept. no. 28 on Contract Nonr-220(03). Oct 58, 19p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 143 241

An experimental study has been carried out for the purpose of verifying theoretical predictions concerning the relations between total absorptivities and total emissivities for transparent gases. The experimental conditions have been designed in such a way as to permit a direct check of theoretical relations derived for (a) non-overlapping dispersion lines and (b) spectral lines with sufficient pressure broadening to permit neglect of the rotational fine structure. The apparatus for the measurement of total gas absorptivities is described. Results for total absorptivities of carbon monoxide measured at temperatures between 300 and 500°K are given and total emissivities have been calculated in the temperature range of 300 to 1600°K. The range of total gas pressure is 0 to 515 psia.

Institute of Mathematical Sciences, New York U., N. Y.
GROWTH OF DROPS BY CONDENSATION, by Ignace I. Kolodner. Rept. on Contract DA 18-064-cml-2518. Mar 55, 30p. 4 refs. IMM-NYU-215; AD-121 943.
Order from LC mi$2.70, ph$4.80 PB 143 262

When the vapor pressure (or concentration) in air surrounding a liquid nucleus exceeds the saturation pressure for a given temperature, vapor will condense on the nucleus and the drop will grow; effort is made to determine this growth. The problem is preliminary to a more difficult study of the behavior of a collection of drops in a supersaturated medium, a situation which may serve as a model of the formation of clouds. The problem is formulated, and the results obtained are compared with those already available. The remainder of the paper is devoted to derivations and proofs.

Instituto de Quimica Fisica (Spain).
KINETICS OF THE SULPHURATION OF METALLIC SURFACES, by J. Llopis, J. M. Gamboa, and L. Arizmendi. Annual rept. no. 2 on Contract AF 61(514)1329. May 59, 48p. 11 refs. AFOSR-TN-59-597; AD-217 180.
Order from LC mi$3.30, ph$7.80 PB 143 681

Surface reaction of copper with solutions of diphenylthiourea: The kinetics of the surface reaction of copper with solutions of diphenylthiourea in xylene has been followed by the radiochemical method. This reaction yields coherent sulphide films, showing neat and uniform interference colors. In the circumstances of these experiments, the reactivity of the diphynylthiourea with copper is lower than that of thiourea in

aqueous solution and the kinetic law of the film growth is linear with time. Surface reaction of copper with solutions of diethyl polysulphides: The results of the present experiments suggest that diethyl disulphide, dissolved in dry xylene, does not react with copper, while diethyl trisulphide in the same conditions does react, giving up the three atoms of sulphur to form a film of sulphide on the surface. In the reaction of trisulphide, the kinetic law of film growth is linear with time. The films of sulphide formed are at first coherent and show interference colors; however, black circular stains soon appear and the corrosion rate increases then appreciably with time. The influence of free sulphur in mixed xylenic solutions with diethyl trisulphide has been studied. (See also PB 136 867)

John Harrison Lab. of Chemistry, U. of Pennsylvania, Philadelphia.
INVESTIGATIONS OF THE COVERAGE OF ELECTRODES WITH ADSORBED ATOMIC HYDROGEN DURING HYDROGEN EVOLUTION, by
J. O'M. Bockris and F. Colum. Rept. on Contract Nonr-551(22). 31 Dec 58, 36p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 143 849

The study of the ionization of adsorbed H on non-noble metal electrodes carried out in alkaline solutions is described in this report. Most of the experimental procedures in this work were similar to those used in Devanathan's work.

Linfield Research Inst., McMinnville, Oreg.
RESEARCH ON ELECTROLYTIC MICROMACHINING TECHNIQUES OF REFRACTORY METALS FOR USE IN FIELD EMISSION DEVICES, by H. W. Pitman and D. C. Hamby. Quarterly progress rept. no. 1, 15 July-15 Oct 58, on Contract DA 36-039-sc-78191. [1958] 49p. 10 refs.
Order from LC mi$3.30, ph$7.80 PB 143 697

Existing literature data on the emf of the tungsten electrode in alkaline electrolytes is analyzed with a view toward establishing the electrode process responsible for the observed dependence of emf on pH and tungstate ion concentration. Coulometric measurements on the tungstic oxide layer forming process have been initiated and an estimate of the forming field required to produce oxide growth has been obtained for formations in dilute nitric acid. Initial runs in the establishment of a calibration curve for spectrophotometric tungsten analysis are being made.

Minnesota U., Minneapolis.
A MODIFICATION OF THE METHOD OF FLASH PHOTOLYSIS AND ITS APPLICATION TO THE STUDY OF LABILE INTERMEDIATES IN REACTIONS SENSITIZED BY COMPLEX MOLECULES, by Robert Livingston. Final rept. for 1 Sep 55-31 Mar 59 on Contract AF 18(600)1485. 12 Aug 59, 12p. 3 refs. AFOSR-TR-59-114.
Order from LC mi$2.40, ph$3.30 PB 143 630

This project was initiated to obtain quantitative information regarding the spectroscopic properties and reactions of photochemically-produced labile states of certain polyatomic molecules. A modification of the flash photolytic technique was used in those studies and a substantial part of our time was spent in developing and testing new apparatus. The half lives of the triplet states of chlorophyll and anthracene in solution and the quenching action of certain compounds upon these triplet states were measured.

Missouri U., Columbia.
ELECTROCHEMICAL SYSTEMS FOR USE IN LOW TEMPERATURE BATTERIES, by
G. M. Arcand and J. R. Tudor. Quarterly progress rept. no. 1, 17 Mar-16 June 58, on Contract DA 36-039-sc-74994. [1958] 49p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 138 837

Progress is reported on a fundamental investigation of KSCN and water in acetonitrile, of $ZnCl_2$ in dry propionitrile. Load tests at room temperature have been made on magnesium-manganese dioxide and zinc-manganese dioxide cells employing $KSCN-H_2O-CH_3CN$ electrolytes.

Modena U. (Italy).
ANODIC BEHAVIOR OF HYDROGEN PEROXIDE ON PLATINUM ELECTRODES, by G. Bianchi, G. Caprioglio and others. Technical scientific note no. 4 on Contract AF 61(052)85. 30 Apr 59, 38p. 16 refs. AFOSR-TN-59-921.
Order from LC mi$3.00, ph$6.30 PB 143 637

The evolution of oxygen from the acid solutions of hydrogen peroxide begins on platinum at low anodic tensions (+800 mV), on account of the probable intervention of the platinum oxides. At greater current densities, the process occurs in the same conditions as on other metals, like gold, and probably requires the intervention of the adsorbed atomic oxygen. The reaction between hydrogen peroxide and adsorbed oxygen would give rise to the evolution of the oxygen. The adsorption and the formation of platinum oxides can explain the anodic phenomena of hysteresis. In alkaline solutions the oxidation of hydrogen peroxide occurs on platinum with the same mechanism as on other metals. At greater current densities the discharge of the ions OH^- and the formation on platinum of a film of adsorbed OH radicals can intervene. The radicals can react with hydrogen peroxide to give rise to the evolution of oxygen.

Modena U. (Italy).
ELECTROCHEMICAL BEHAVIOR OF GRAPHITE ELECTRODES IN SOLUTIONS OF VARIOUS pH CONTAINING OXYGEN AND HYDROGEN PEROXIDE, by G. Bianchi, G. Caprioglio and others. Technical scientific note no. 3 on Contract AF 61(052)85. 30 Apr 59, 42p. 10 refs. AFOSR-TN-59-708.
Order from LC mi$3.30, ph$7.80 PB 143 596

Polarization measurements with graphite electrodes were affected in solutions of different pH, with oxygen or CO_2 bubbling and varying the H_2O_2 concentration of the solutions from zero to 10^{-1}M. Variations of potential with time at the moment of opening and closing the polarization circuit were also registered.

The results were interpreted by considering the intervention of processes occurring on graphite, which, however, does not behave as an inert electrode with respect to oxygen and H_2O_2 processes. The intervention of the electrode is manifested under the form of processes presumably due to the presence of the superficial oxide C (O) and to adsorbed carbonates $(CO\bar{3}^{-})_{ads.}$. Such processes can substitute or superimpose those concerning H_2O_2 and oxygen particularly in the case of acid solutions.

Naval Ordnance Lab., White Oak, Md.
ON THE NUMERICAL SOLUTION OF THE ADIABATICALLY EXPANDING GAS BUBBLE OF VARIABLE MASS IN AN INFINITE LIQUID MEDIUM, by Bernard Chern and Julius W. Enig. 20 Jan 58, 14p. 20 refs. NAVORD rept. 5735.
Order from LC mi$2.40, ph$3.30 PB 143 307

This report describes the behavior of a gas bubble, free from external forces and immersed in an infinite liquid medium, when gas is added to the bubble at a constant mass rate. Numerical solutions are obtained giving the bubble pressure, radius and temperature as a function of time for different values of mass addition rate. It is shown that the gas bubble reaches a first maximum pressure $P_{max}^{(1)}$, much greater than subsequent maxima. Up to the first pressure maximum, the bubble expansion is seen to be approximately isothermal. In terms of the reduced pressure, P, and a dimensionless parameter C, the relation

$$P_{max}^{(1)} = 1 + 0.5532\, C^{0.6808} \quad ; 0 \leq C \leq 2000$$

holds over the range studied.

Naval Research Lab., Washington, D. C.
CONSTITUTIVE RELATIONS IN THE WETTING OF LOW-ENERGY SURFACES AND THE THEORY OF THE RETRACTION METHOD OF PREPARING MONOLAYERS, by Elaine G. Shafrin and W. A. Zisman. Interim rept. 21 Oct 59, 14p. 32 refs. NRL rept. 5394.
Order from OTS $0. 50 PB 151 936

Earlier systematic studies of the angle of contact θ exhibited by drops of liquid on plane, solid surfaces of low surface energy have revealed a regular linear variation in cos θ with the surface tension (γ_{LV}) of a large variety of liquids; this led to the concept of the critical surface tension of spreading (γ_C) and its use in characterizing the wettability of organic solids and of high-energy surfaces coated with adsorbed organic films. The wetting properties of low-energy organic surfaces are shown to depend upon the chemical structure and the physical packing of the atom groups in the outermost layer. For hydrocarbons, wettability decreases with increasing hydrogenation. Fluorine is the most effective hydrogen substitute in decreasing γ_C, whereas Cl, Br, I, O, and N increase the wettability of organic surfaces. The "retraction method" of preparing monomolecular films from solutions on solids is shown to be a direct consequence of the above constitutive law of wetting. The same analysis, applied to a pure liquid, results in the explanation of the behavior of the autophobic liquids at room temperature and of the process of depositing a monolayer on a solid by retraction from the melt over a range of temperature.

Naval Research Lab., Washington, D. C.
METALS COATED WITH FILMS OF LOW SURFACE ENERGY AS REFERENCE ELECTRODES FOR THE MEASUREMENTS OF CONTACT POTENTIAL DIFFERENCES, by K. Bewig and W. A. Zisman. Final rept. 23 Oct 59, 15p. 23 refs. NRL rept. 5383.
Order from OTS $0. 50 PB 151 994

The central problem in the measurement of the contact potentials of solid and liquid surfaces in gaseous atmospheres is the stability of the contact potential of the reference electrode to which the potential difference between the two is referred. Noble metals, such as gold or platinum, are usually employed as reference electrodes, but, in gaseous atmospheres, their contact potentials can change significantly because of vapor adsorption on the reference surfaces. This occurs even on aged metals, the effect of adsorbed water vapor being especially great. But a metal which had been coated with a low-energy film, such as Teflon or FEP Teflon resin, exhibits little change in the contact potential in a wide variety of polar and nonpolar vapors. This is demonstrated by the results of recent studies of metals in a nitrogen atmosphere in which the water-vapor content was varied from 1% to as high as 91% R. H. Teflon-coated metal reference electrodes have proved to be remarkably stable under these conditions.

Naval Research Lab., Washington, D. C.
SURFACE ACTIVITY OF FLUORINATED ORGANIC COMPOUNDS AT ORGANIC-LIQUID/AIR INTERFACES. PART III. EQUATION OF STATE OF ADSORBED MONOLAYERS AND WORK OF ADSORPTION OF A FLUOROCARBON GROUP, by N. L. Jarvis and W. A. Zisman. Interim rept. 17 Nov 59, 10p. 12 refs. NRL rept. 5401.
Order from OTS $0. 50 PB 151 997

Previous investigations have demonstrated that a wide variety of partially fluorinated carboxylic esters are capable of adsorbing as unimolecular films at the interfaces between various organic liquids and air, and also that these films are usually in a gaseous or otherwise expanded state. In the present study it is shown that isotherms of film pressure (F) vs area (A) per adsorbed molecule of solute, at large values of A, obey the simple equation of state $(F + F_O)(A - A_O) = kT$. However, as the film pressures increase, the deviation from this equation increases. The two-dimensional analog of the van der Waals equation $(F + a/A^2)(A - A_O) = kT$, which includes a more definitive correction factor for the intermolecular attraction between neighboring molecules in the film, was in good agreement with the experimental data even at very low areas per molecule. The constants a and A_O of the van der Waals equation were calculated for the F vs A isotherms of solute in various solvents, and the relation of these constants to the organophobic-organophilic balance in the solute molecules and to the association of solute and solvent molecules is discussed. In addition, the work of adsorption $\Delta\lambda$ of $-CF_2-$ groups at each organic-liquid/air interface was calculated. The plot of $\Delta\lambda$ vs solvent surface tension was a straight line, which extrapolated fairly well to the value for $-CF_2-$ groups adsorbed at the water/air interface, as determined from surface tension vs concentration isotherms given in the literature for fluorinated solutes in water. (See also PB 151 808)

Ohio State U. Research Foundation, Columbus.
THE SOLUBILITY OF HYDROGEN IN DIBORANE, by Jih-Heng Hu and George E. MacWood. Technical research rept. Jan 56, 17p. 6 refs. MCC-1023-TR-196.
Order from LC mi$2.40, ph$3.30 PB 144 094

The solubility of hydrogen in liquid diborane was determined in the temperature range 113-181°K and the pressure range 0-40 atm. The solubility is found to increase with temperature. The heat of solution at infinite dilution ranges from 386-601 cal./mole.

Oregon U., Eugene.
PRESSURE BROADENING OF THE VIOLET TRIPLET OF MANGANESE IN THE PRESENCE OF ARGON AND HELIUM, by Shang-Yi Ch'en and Robert B. Bennett. Interim technical rept. no. 2, 1 Dec 57-Aug 59, on The Modification of the Shape and Positions of Spectral Lines by Foreign Gases under Well-Defined Conditions of High Pressure and High Temperature, Contract DA 04-200-ORD-713. [1959] 10p. 4 refs. AD-226 185.
Order from LC mi$1.80, ph$1.80 PB 144 026

The λ4030 absorption triplet of Mn ($3d^5 4s^2$, ^6S - $3d^5 4s4p$, ^6P) was studied under various pressures of argon and helium of relative density ranging from 1 to 30. The result indicates the inverse sixth power law of interatomic interaction and that the difference in interaction energy constant for the ground ^6S state and the excited ^6P states of Mn in argon is 3×10^{-58} erg cm^6.

Pennsylvania State U. [University Park].
REACTION OF ALKOXIDE IONS WITH CX_2 TO PRODUCE CARBONIUM ION INTERMEDIATES, by P. S. Skell and I. Starer. Technical rept. no. 3 for 15 June 58-15 June 59 on Reactivity of Methylenes (Bivalent Carbon Species), Contract DA 36-061-ORD-607. [1959] 5p. 6 refs; AD-217 886.
Order from LC mi$1.80, ph$1.80 PB 143 322

A method for producing highly reactive carbonium ion inter ediates in basic media.

Polytechnic Inst. of Brooklyn, N. Y.
CELL-VACANCY THEORY OF LIQUIDS, by Abdel S. Said and Frank C. Collins. Rept. on Study on Relation of Chemical Composition, Structure, and Physical Environment to Viscosity, Thermal Conductivity and Diffusion, Contract AF 33(616)3894. June 59, 14p. 8 refs. WADC Technical note 59-154.
Order from OTS $0.50 PB 161 109

The cell vacancy theory of Peek and Hill had been refined by spherically symmetrizing the cell density calculated from a cell potential which is unsymmetrically perturbed by the presence of an adjacent vacant cell instead of first spherically symmetrizing the cell potential before constructing the cell density as done by Peek and Hill. The refined procedure enables the enhanced density in the cell in the immediate neighborhood of the vacancy to be more fully taken into account. A variable fraction of vacancies is permitted by superposing the cell densities of a cell with no adjacent vacancies and a cell with one adjacent vacancy. In contrast to the results of Peek and Hill, minimizing the free energy in the present instance, predicts a substantial fraction of vacancies at normal liquid densities. The calculated pressure is not significantly improved. Further improvement of the cell-vacancy theory would require detailed calculations of the non-symmetrized cell density for various arrangements of multiple adjacent vacancies.

Rocketdyne, Canoga Park, Calif.
RESEARCH ON NITRIC ACID-SUPPORTED COMBUSTION, by R. J. Thompson. Final progress rept. on Contract AF 49(638)163. Mar 59, 66p. 13 refs. R-1157; [AFOSR]-TR-59-1; AD-208 301.
Order from LC mi$3.90, ph$10.80 PB 143 916

Details concerning an investigation of nitric acid flames with methane, propane, hydrogen, and acetylene are presented. Flame stability limits, flame speeds, combustion products and emission spectra were studied. (See also PB 135 609)

Stanford Research Inst., Menlo Park, Calif.
A FEASIBILITY STUDY: SUPERIMPOSED BEAMS: A TECHNIQUE FOR DETERMINING TWO-BODY REACTION CROSS SECTIONS, by Charles J. Cook and Clarence M. Ablow. Scientific rept. no. 1 on Contract AF 19(604)3475. 17 Sep 59, 54p. 38 refs. AFCRC-TN-59-472.
Order from LC mi$3.60, ph$9.30 PB 143 685

Crossed molecular beams cannot be utilized to measure two-body reaction cross sections for arbitrary reactants due to difficulties of production and detection of all but a few selected species. However, a wide range of reactants can be produced in fast (kev) beams and can be individually detected. Similarly, the reaction products resulting from superimposing two fast beams could be individually detected. The feasibility of accurately determining two-body reaction cross sections by a superimposed beam technique has been investigated. The apparatus described must be improved before accurate studies of ion-ion recombinations or sharply resonant chemical reactions can be made.

Stanford Research Inst., Menlo Park, Calif.
LATTICE ENERGIES OF THE ALKALI HALIDES AND THE ELECTRON AFFINITIES OF THE HALOGENS, by Daniel Cubicciotti. Technical note no. 4 on Contract AF 49(638)89. July 59, 24p. 27 refs AFOSR-TN-59-726.
Order from LC mi$2.70, ph$4.80 PB 143 162

The overlap repulsion parameters that occur in the Born-Mayer treatment of lattice energies have been re-evaluated for the alkali halides from recent compressibility data. With these parameters the lattice energies of the alkali halides were calculated. The lattice energies were combined with thermochemical

data to calculate the electron affinities of the halogens. The values obtained were: F 80.2; Cl 85.0; Br 79.5; I 72.5 kcal/mole.

Syracuse U., N. Y.
STUDY OF THE MIGRATION AND DESCRIPTION OF A DIMORPHIC ADSORBATE USING THE FIELD EMISSION MICROSCOPE: TITANIUM ON TUNGSTEN, by Robert C. Abbott and Allan M. Russell. Technical rept. on Contract AF 49(638)93. June 59, 49p. 31 refs. AFOSR-TR-59-89.
Order from LC mi$3.30, ph$7.80 PB 143 678

The desorption was measured by the field emission technique and the activation energies were determined. In addition, estimates were made for the average number of titanium-titanium and titanium-tungsten bonds broken during migration and desorption.

Washington U., Seattle.
RESEARCH IN HETEROGENEOUS CATALYSIS, by G. D. Halsey, Jr. Technical rept. for 15 Sep 53-15 Sep 59 on Contract AF 18(600)987. [1959] 10p. 8 refs. AFOSR-TR-59-127.
Order from LC mi$1.80, ph$1.80 PB 143 909

Papers covering the project are listed. None have been published. A summary of the present status of the problem is also given.

EARTH SCIENCES

Oregon State Coll. School of Science, Corvallis.
HYDROGRAPHY OF OREGON ESTUARIES, by Wayne V. Burt and Bruce McAlister. Data rept. no. 3, June 56-Sep 58, on Contract Nonr-1286(02). Oct 58, 20p. Reference 58-6.
Order from LC mi$2.40, ph$3.30 PB 143 699

Unpublished hydrographic data for Oregon Estuaries (Alsea, Columbia, Coos, Nehalem, Netarts, Siletz, Siuslaw, Tillamook, Umpqua, and Yaquina) are tabulated.

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
ACCURACY OF MEAN MONTHLY GEOSTROPHIC WIND VECTORS AS A FUNCTION OF STATION NETWORK DENSITY, by Henry A. Salmela. June 59, 45p. 3 refs. Air Force Surveys in Geophysics no. 112; AFCRC-TN-59-268; AD-217 034.
Order from OTS $1.25 PB 161 113

Two experiments, aimed at studying the accuracy of analyses of mean monthly contour charts at three levels, with five different densities of station network coverage in one experiment and four in the other, are described. The results of the experiments show that when geostrophic winds computed from mean monthly upper-air contour charts based on sparse data coverage are compared to those derived over areas of optimum coverage a quantitative measure of the relative accuracy is obtained.

Air Force Cambridge Research Center, Bedford, Mass.
NUMERICAL EXPERIMENTS IN FORECASTING AIR AND SOIL TEMPERATURE PROFILES, by Donald W. Stevens. July 59, 68p. 42 refs. GRD Research notes no. 12; AFCRC-TN-59-252.
Order from OTS $1.75 PB 161 151

A numerical forecasting model based on Taylor's heat-transfer equation for the atmosphere and the classical heat-conduction equation for the soil is presented. The surface energy-budget equation is solved for the surface temperature, and the equations are integrated numerically to provide 4-hour forecasts of the temperature profiles in the soil and atmosphere. Five experiments using different functional forms for eddy conductivity are described, and the results are compared with observations. The last experiment showed reasonably good agreement between the forecast and observed temperatures, the maximum error being 1.6°K. The model constants producing this result are not unreasonable in the light of present knowledge of the magnitude and vertical variation of the eddy conductivity. The shortcomings of the model are discussed, and some plans for further testing are listed. Suggestions for improving the model are presented, and a brief discussion of the potentialities of an analogue computer for solving problems of this type is given.

Air Weather Service, Washington, D. C.
MEMORANDUM ON DENSITY-ALTITUDE. Sep 57, 15p. 7 refs. AWS Technical rept. no. 105-101 (Rev. 2).
Order from LC mi$2.40, ph$3.30 PB 143 289

Basic definitions and discussions are presented.

[Army Signal] Radio Propagation Agency, Fort Monmouth, N. J.
COMPARISON OF PREDICTED AND OBSERVED SIGNALS ON A NORTH ATLANTIC PATH, by Luther C. Kelley. July 56, 16p. Proj. 419.
Order from LC mi$2.40, ph$3.30 PB 143 139

The objective of this report is to determine the accuracy of the method presented in Technical Report No. 9 (PB 103 045) for determining the monthly median received signal intensity of a high frequency radio circuit whose path crosses the North Atlantic and skirts the auroral zone. Observed data (receiver input voltage) is available for the circuit, GLH, Dorchester, England to Riverhead, Long Island, New

York. The validity of Technical Report No. 9 methods for this type of path is to be checked by comparing observed and calculated values. The period considered is January 1947 to December 1949 inclusive.

Blue Hill Meteorological Observatory, Milton, Mass.
CLOUD PATTERNS AND RELATED AIR MOTIONS DERIVED BY PHOTOGRAPHY, by John H. Conover. Final rept. on Contract AF 19(604)1589. June 59, 273p. 24 refs. AFCRC-TR-59-246; AD-215 936.
Order from LC mi$11.10, ph$42.60 PB 143 659

Under conditions of strong winds a banded structure of the troposphere, approximately parallel to the wind, may be revealed by clouds at any level. The following band types and their approximate dimensions were found at cirrus levels: large scale, 100 mi apart and up to at least 350 mi long; major bands 2.3 mi apart and up to at least 80 mi long; minor bands 0.2 mi apart and a few miles long. At altocumulus levels major bands are found. Sharp edges to extensive cirrus sheets or banded cirrus are generally found a few miles south of the jet stream core. "Streaky" cirrus denotes jets to the north and south. When banded or "streaky" cirrus is observed 50% of the time it lies on the warm side and within 200 mi of the jet core and in the entrance or neutral regions. Horizontal vortices, approximately parallel to the wind, through which the air flows in a helical motion create the major cloud bands. Adjacent vortices rotate in opposite directions. Cloud forms between vortices in rising air and spreads laterally, depending on the average shear and lapse rate through the layer of cloud formation. Cumulus cloud streets appear to be unaffected by irregularities of at least 700 ft in the earth's topography; they generally form in vortices of like rotation, the intervening vortices apparently are wiped out by the prevailing horizontal shear. The sea breeze may cause lifting to at least 16,000 ft as shown by stationary clouds at that level. Thunderstorm roll clouds rotate upward on the advancing side about a horizontal axis. Vertical motions dangerous to aircraft, operating at levels in which these rolls form, may be encountered.

Blue Hill Meteorological Observatory, Milton, Mass.
GROUND TEMPERATURE, VOLUME I, by Jen-Hu-Chang. Rept. on Contract DA 19-129-qm-348. 21 June 58, 305p. 402 refs.
Order from LC mi$11.10, ph$47.10 PB 143 364

This volume contains a comprehensive study and bibliography on the subject of ground temperature.

Chicago U., Ill.
ON THE INFLUENCE OF HEAT EXCHANGES ON MOTION AND WEATHER SYSTEMS, by Sverre Petterssen. Scientific rept. no. 10 on Contract AF 19(604) 2179. July 59, 18p. 11 refs. AFCRC TN-59-446.
Order from LC mi$2.40, ph$3.30 PB 143 027

In the present report is given a brief summary of the results of two pilot projects, the one dealing with stationary systems over the Great Lakes and the other with mobile systems on the North Atlantic Ocean.

Massachusetts Inst. of Tech., Cambridge.
NOTE ON VERTICAL VARIATIONS IN RADAR REFLECTIVITY, by C. William C. Rogers. Technical note no. 1 on Weather Radar Research, Contract AF 19(604)2291. June 59, 17p. 6 refs. AFCRC-TN-59-427.
Order from LC mi$2.40, ph$3.30 PB 143 401

This paper presents the results of a survey of the frequency of occurrence of detectable increases or decreases in radar reflectivity with height in the lower levels of the atmosphere. The survey is based on a series of RHI photographs taken by the Air Force at its AN/CPS-9 radar at Great Blue Hill. Only situations characterized by continuous non-showery precipitation were used. The total number of cases analyzed was 805; of these, 470 were in rain echoes below the bright band and 335 were in snow. It was found that by far the majority of the cases showed no detectable change in reflectivity with height in the lower levels of the atmosphere. The relationship between variations in reflectivity with height and the vertical velocity profiles is discussed. It is pointed out that larger vertical velocities and greater variations in reflectivity with height are observed in the middle atmosphere and it is suggested that in further studies of the relationship between these parameters attention should be directed toward the upper levels.

Naval Research Lab., Washington, D. C.
UPPER ATMOSPHERE RESEARCH REPORT NO. XXXIII. AEROBEE-HI REPORT NUMBER 6; SINGLE-LINE-SCAN TELEVISION FOR SPINNING ROCKETS, by F. H. Harris and J. Ainsworth. 11 Aug 58, 15p. 9 refs. NRL rept. 5168.
Order from LC mi$2.40, ph$3.30 PB 134 203

A brief experimental and theoretical study was made of the practicability of using a vidicon camera tube to measure the space orientation of spin stabilized Aerobee-Hi research rockets. The usual television camera tube xy scan was replaced by a single-line y scan and the motion of the image obtained by rotation of the television camera was used in lieu of the x scan. While ordinary television pictures are badly blurred by camera rotation, laboratory photographs which were obtained by means of a spinning, line scan camera demonstrated that this method can be used to obtain pictures whose quality is similar to those of standard television. Design equations for determining the sensitivity and resolution of a vidicon camera tube with single-line scan were derived and verified experimentally. It is concluded that with the use of a single-line scan, satisfactory sensitivity and resolution can be obtained with compact lightweight equipment, low power consumption, simplified circuitry, and reduced transmission bandwidth.

New York U. Coll. of Engineering, N. Y.
THE DIURNAL VARIATION OF TEMPERATURE NEAR TROPOPAUSE DUE TO A DIURNAL VARIATION OF TERRESTRIAL RADIATION, by Paul A. Davis. Scientific rept. no. 5 on Contract

AF 19(604)1755. June 59, 44p. 15 refs. AFCRC-TN-59-424.
Order from LC mi$3.30, ph$7.80 PB 143 592

Computations are made of the diurnal temperature variation experienced by the atmosphere in the 8-18 kilometer region as a result of the diurnal variation of terrestrial radiation reaching each layer. The methods of calculation are discussed in detail. For the two localities considered, Albuquerque, New Mexico and Bismarck, North Dakota, the diurnal ranges of temperature resulting from the terrestrial radiation were found to be less than 0.05°C. Of the three infrared absorbers considered, ozone contributed most to the diurnal temperature variation, followed by carbon dioxide and water vapor respectively. (See also PB 140 212)

New York U. Coll. of Engineering, N. Y.
VALLEY WIND STUDIES IN VERMONT, 1957, by Ben Davidson and P. Krishna Rao. Preliminary rept. on Contract AF 19(604)1971. Nov 58, 61p. 12 refs. AFCRC-TR-58-29.
Order from LC mi$3.90, ph$10.80 PB 138 594

A series of experiments, designed to isolate the effects of valley geometry and prevailing wind on the valley-wind system is described in detail.

Quartermaster Research and Engineering Center, Natick, Mass.
ATLAS OF MEAN DAILY MINIMUM TEMPERATURES, by Samuel Van Valkenburg, Henry J. Warman (Clark U.) and William C. Robison. May 59, 32p. 5 refs. Technical rept. EP-110.
Order from LC mi$3.00, ph$6.30 PB 143 788

The report, shows the worldwide variation, by seasons, of a climatic element that is a useful criterion of the degree of cold stress to be expected in a given area. The maps in this atlas have a direct application in determining clothing allowance zones and areas of issue for other items designed to meet specified temperature minima. The maps will serve as a useful reference in environmental research.

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS VII. ANALOGS OF CANAL ZONE CLIMATE IN INDONESIA, THE PHILIPPINES AND BORNEO, by Will F. Thompson. June 59, 57p. 22 refs. Technical rept. EP-116.
Order from LC mi$3.60, ph$9.30 PB 143 281

The climate of Indonesia, the Philippines, and Borneo is compared with that of two localities in the Canal Zone: Balboa Heights, representing the drier, leeward Pacific side of the Isthmus of Panama, and Cristobal, representing the wetter, windward, Atlantic side. Distribution of areas of analogy of pertinent climatic elements and combinations of these elements are shown on maps. (See also PB 137 857)

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS VIII. ANALOGS OF CANAL ZONE CLIMATE IN AUSTRALIA AND NEW GUINEA, by Walter Beale Blair and Jack V. Chambers. Rept. on Military Evaluation of Geographical Areas. July 59, 60p. 15 refs. Technical rept. EP-113.
Order from LC mi$3.60, ph$9.30 PB 143 832

The climate of Australia and New Guinea is compared with that of two locations in the Canal Zone: Balboa Heights, representing the drier, leeward, Pacific side of the Isthmus of Panama, and Cristobal, representing the wetter, windward, Atlantic side. Areas of analogy of pertinent climatic elements and combinations of these elements and combinations of these elements are shown on maps. (See also PB 143 281)

Sperry Gyroscope Co., Great Neck, N. Y.
A FLIGHT INVESTIGATION OF THE PERFORMANCE OF LOW CEILING/VISIBILITY METEOROLOGICAL EQUIPMENT. Summary rept. on Contract CCA 29773. Oct 54, 55p. Sperry rept. no. 5245-4060.
Order from LC mi$3.60, ph$9.30 PB 144 114

A general analysis of the flight test data has been performed. The results of this analysis can be used to determine what a pilot will see from the cockpit under observed meteorological and photometric conditions at any airport equipped with the ceilometer-transmissometer system. Information which is not currently available to the pilot, such as when the pilot can first see the ground, the approach lights, and the end of the runway, can be obtained from this system. This information, when used by the pilot, can provide an improvement in approach success and an increase in the safety of instrument approaches.

Stanford Research Inst., Menlo Park, Calif.
STUDY OF WEATHER STATIONS FOR ARMY USE. PHASE I: STATE OF THE ART, by I. G. Poppoff, G. B. Bell and others. Summary rept. on Contract DA 36-030-sc-78154. 15 Dec 58, 110p. 303 refs.
Order from LC mi$5.70, ph$16.80 PB 143 774

This report covers Phase I of a survey of the field of semi-automatic and automatic weather stations. Detailed results of the survey are presented as an annotated bibliography appended to this report.

Texas A. and M. Research Foundation, College Station.
SOME NON-PRECIPITATION ECHOES AS OBSERVED BY CPS-9 RADAR, by Stuart G. Bigler. Scientific rept. no. 1 on Contract AF 19(604)3864. Sep 59, 37p. 28 refs. Reference 59-12T; AFCRC-TN-59-475; AD-225 977.
Order from LC mi$3.00, ph$6.30 PB 143 590

Echoes from regions in the atmosphere where no reflecting or scattering sources could be seen are described. Such echoes, commonly called angels, include the following types, (1) thin lines associated with wind shifts in dry fronts, and preceding squall lines and air-mass showers, (2) echoes arranged in

layers aloft, (3) others which are uniform and diffuse, (4) fibrilliform echoes presumably resulting from thermals, and (5) mantle echoes which correspond to the outer boundaries of cumulus clouds. One or more of these echo types were photographed on 79% of the 37 radar operating days between 1 June and 23 July 1958. Meteorological conditions during the observations are described. First gust lines associated with scattered showers and thunderstorms are considered in some detail. Illustrations of the PPI and RHI presentations of these lines as well as wind, pressure, and temperature records are included. It is concluded that these thin lines are the boundary of mesosystems and provide another method for study of the characteristics of mesosystems.

Travelers Insurance Co., Hartford, Conn.
MULTIVARIATE STATISTICAL ANALYSIS OF ATMOSPHERIC PROCESSES, by Thomas F. Malone. Final rept. on Contract AF 19(604)3877. 1 Aug 59, 86p. 26 refs. AFCRC-TR-59-271.
Order from LC mi$4.80, ph$13.80 PB 143 519

Section I is an objective method for classifying sets of observed weather elements into groups, the classification depending upon events observed on the next day. Probabilities can be derived for various classes of events, and a screening type procedure can be applied to select the important classificatory variables. Canonical correlation, described in Section II provides a measure of the strength of the relationships between one entire set of variables and another entire set and thus may be viewed as a generalization of multiple correlation. In Section III the design of a large-scale experiment to examine this problem is described. The paper emphasizes the concept of a coordinate system moving with the storm center, outlines data-gathering procedures for the 352 cases, and presents plans for the data analysis.

Frost Science

Army Snow, Ice, and Permafrost Research Establishment [Wilmette, Ill.]
SECOND SIPRE SNOW COMPACTION CONFERENCE, 24-25 MAY 1951. June 51, 53p. SIPRE rept. no. 3.
Order from LC mi$3.60, ph$9.30 PB 143 363

Wisconsin U. [Madison.]
JUNEAU ICE FIELD RESEARCH PROJECT. Semi-annual status rept. on Contract N9onr-83001. 26 Nov 58, 7p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 143 614

A tripartite program of glaciological and related studies was conducted on Lemon Creek Glacier, on Gilkey Clacier, and on ice-dammed Tulsequah Lake.

Geodesy

Army Engineer Research and Development Labs., Fort Belvoir, Va.
A PROPOSED STEREOPHOTOGRAMMETRIC SYSTEM FOR TOPOGRAPHIC MAPPING FROM PHOTOGRAPHY TAKEN AT ALTITUDES UP TO 100,000 FEET, by J. W. Halbrook. 1 Apr 58, 18p. 1 ref. Technical rept. 1518-TR.
Order from LC mi$2.40, ph$3.30 PB 143 269

It is recognized that higher ceilings of aircraft will entail mapping for military purposes from photography taken above 50,000 ft. It is known that present day plotting equipment is not sufficiently precise to permit plotting of accurate large-scale military maps from photography taken at such altitudes. The system proposed as having a chance of meeting the requirements consists of convergent, 18-in. focal length, 9- by 9-in. format cameras with an optical projection plotting instrument to match. Magnification will be such that operator errors are smaller, percentage-wise. It is expected that the effect of reducing errors from all sources will result in sufficient accuracy to draw 20-ft contours approaching national map accuracy standards from 100,000-ft photography. It is concluded that: (a) it is possible to prepare topographic maps with 20-ft contours from photographs taken at altitudes up to 100,000 ft, (b) the proposed system is expected to produce maps that will meet emergency accuracy standards and possibly peacetime standards, and (c) the analytical method offers the best solution to the problem of triangulation.

Quartermaster Research and Engineering Center, Natick, Mass.
PREDICTIVE METHODS IN TOPOGRAPHIC ANALYSIS: II. ESTIMATING RELIEF FROM WORLD AERONAUTICAL CHARTS, by Walter F. Wood and Joan B. Snell. June 59, 23p. 3 refs. Technical rept. EP-114.
Order from LC mi$2.70, ph$4.80 PB 143 428

A method has been developed for obtaining an estimate of relief of an area from the World Aeronautical Charts (scale 1:1,000,000). This consists of determining a value for the lowest elevation and a value for the highest elevation of an area: relief of the area is the difference between these two values. The technique for determining lowest elevations is based on an assumed geometric progression of elevations along a stream; the technique for determining highest elevations depends on an arithmetic progression of elevations on a land surface. The accuracy of these methods was tested on 197 160-square-mile areas in the United States. Correlation of relief values at a scale of 1:1,000,000 with values for the same areas at a scale of 1:62,500 resulted in a coefficient of correlation of .9952. For the most part, relief from the 1:1,000,000-scale maps was within 200 feet of error. A series of regression equations has been devised which can be applied to improve these estimated values. Since it has been demonstrated that it is possible to obtain a realistic relief figure from the World Aeronautical Charts, rather serious limitations to quantitative terrain analysis, imposed by inadequate map coverage, can be overcome.

Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia.
THE D-LINE METHOD OF ANALYZING A DISTRIBUTION, by Lester E. Klimm. Technical rept. no. 3 on Contract Nonr-551(01). 1 Oct 58, 14p. 1 ref.
Order from LC mi$2.40, ph$3.30 PB 143 796

Geographers and other investigators frequently encounter the problem of making orderly analyses of distributions in which the phenomena occur as interrupted areas of varying sizes and shapes, or as points. Examples of such areas are islands, lakes, cropland, urban agglomerations, clumps of vegetation, etc. On scales suitable for analysis, phenomena such as homesteads, farmsteads, etc., are often considered as dimensionless points. Distance relations between the occurences in a phenomenon having such an interrupted distribution are important qualities of that distribution. In essence, these relations are expressable in terms of distances across the interruptions. These distances across the interruptions may be measured or sampled and statistical results arrived at in terms of maximum, minimum, mode, mean, frequency, etc. In this study, however, attention will be concentrated on the geography of the distribution; i.e., the organization of a map of the distribution into regions with objectively-determined boundaries based on distance relations across interruptions.

Geography

Central Intelligence Agency, Washington, D. C.
CHINA: PROVISIONAL ATLAS OF COMMUNIST ADMINISTRATIVE UNITS. 1959, 51p. (2 color maps will not reproduce) CIA/RR GR 59-20.
Order from OTS $5.00 PB 161 275

Pennsylvania State U., University Park.
AN ANALYSIS OF THE INDUSTRIAL GEOGRAPHY OF THE PORT OF GENOA, ITALY, by Allan L. Rodgers. Status rept. 1957 on Contract [Nonr-656(11)]. 1 Dec 57, 12p. AD-153 773.
Order from LC mi$2.40, ph$3.30 PB 137 918

The present study is concerned with (1) the role of various location factors in the development of industry in Genoa and (2) the relations of the industries of Genoa with the hinterland of the port. It is hoped that the present investigation will shed some light on the overall problem of industrial development in ports especially with respect to the effects of commodity flows through a port of industrial development. (See also PB 134 356)

Quartermaster Research and Engineering Center, Natick, Mass.
ENVIRONMENTAL HANDBOOK FOR THE CAMP HALE AND PIKES PEAK AREAS, COLORADO, by Will F. Thompson and Arthur V. Dodd. Jan 58, 93p. 42 refs. Technical rept. EP-79.
Order from LC mi$5.40, ph$15.30 PB 138 598

This report is one of a series of handbooks, prepared by the Environmental Protection Research Division, on the physical environment of sites where tests are conducted by the Quartermaster Corps and other technical services of the Army. A section on comparisons of the Camp Hale and Pikes Peak areas with other mountain areas of the world has been included to indicate worldwide applicability of the findings.

Wisconsin U., Madison.
PROCEDURES IN THE DESCRIPTIVE ANALYSIS OF TERRAIN, by Edwin H. Hammond. Final rept. on Contract Nonr-1202(01). July 58, 160p. 19 refs.
Order from LC mi$7.50, ph$24.30 PB 143 100

The project originally grew out of the principal investigator's efforts to find, primarily for teaching purposes, an approach to land form study that would be of maximum use to geographers and to other students who are interested in the use of the land. One obvious need appeared to be a method for systematically characterizing the land form in terms of its inherent nature. It was with the hope of partially filling this gap that the present investigation was conceived and proposed.

Geology

Blue Hill Meteorological Observatory, Milton, Mass.
GROUND TEMPERATURE VOLUME II, by Jen-hu-Chang. Rept. on Contract DA 19-129-qm-348. 21 June 58, 215p.
Order from LC mi$9.60, ph$33.30 PB 143 693

This volume contains a collection of ground temperature means at stations located throughout the world. Volume I contains the text of the ground temperature study. The data are arranged alphabetically within continents according to country and station. An alphabetical list of the stations is also included. The assembled data are not homogeneous since the times of observation, the ground conditions and the methods of observation all differ greatly from station to station. However, the methods of observation have been described whenever such information is available. The coordinates of most stations are given. For most stations only the long period monthly means are presented but for a few selected stations the monthly values for individual years have been listed. Only in a very, very few cases have means been computed from data that were not entirely complete.

Coastal Studies Inst., Louisiana State U., Baton Rouge.
PRELIMINARY NOTES ON CARIBBEAN BEACH ROCK, by Richard J. Russell. Technical rept. no. 11 on Contract N7onr-356(08). 1 Nov 58, 17p. Contribution no. 58-4.
Order from LC mi$2.40, ph$3.30 PB 143 423

Johns Hopkins U., Baltimore, Md.
BIBLIOGRAPHY RELATING TO VIBRATORY CUTTING, PENETRATION AND COMPACTION OF SOILS, by Stephen C. Cowin, Robert L. Kondner, and Robert S. Ayre. Technical rept. no. 2 on Contract DA 22-079-eng-210. 3 Jan 58, 41p. 212 refs.
Order from OTS $1.25 PB 161 123

An extensive search of the literature in soil mechanics, soil physics, engineering, geology and agriculture relating to the vibratory cutting, compaction and penetration of soils and on related topics such as vibrated concrete, vehicle mobility and application of ultrasonic vibration. Included in this report are 212 references, most of them with summaries.

Johns Hopkins U., Baltimore, Md.
BIBLIOGRAPHY RELATING TO VIBRATORY CUTTING, PENETRATION AND COMPACTION OF SOILS: SUPPLEMENT NO. 1, by Stephen C. Cowin, Robert L. Kondner, and Robert S. Ayre. Technical rept. no. 3 on Contract DA 22-079-eng-210. 12 Feb 59, 39p. 378 refs.
Order from OTS $1.00 PB 161 124

An extensive search of the literature in soil mechanics, soil physics, engineering, geology and agriculture relating to vibratory cutting, compaction and penetration of soils and on related topics such as vibrated concrete, vehicle mobility and application of ultrasonic vibration. Selected on the basis of primary, related, and historical interests. (See also PB 161 123)

Massachusetts Inst. of Tech., Cambridge.
METHODS AND EQUIPMENTS FOR MEASURING SOIL TEMPERATURE AND HEAT FLOW THROUGH THE SOIL: A LITERATURE SURVEY, by Richard J. Nickerson, Harry Y. Choi, and Stanley Marcus. Rept. on Contract DA 36-039-sc-78174. 15 Jan 59, 19p. 56 refs.
Order from LC mi$2.40, ph$3.30 PB 143 751

Yale U., New Haven, Conn.
POSTGLACIAL CHANGES OF SEALEVEL IN SOUTHWESTERN MAINE, by Richard Foster Flint and Arthur L. Bloom. Annual summary rept. on Contract Nonr-609(25). 1 Dec 58, 2p.
Order from LC mi$1.80, ph$1.80 PB 143 863

Physics of the Atmosphere

Geophysical Inst., U. of Alaska, College.
EXPERIMENT LUXEMBOURG, by G. C. Rumi and C. G. Little. Scientific rept. no. 1 on Contract AF 19(604)3880. Dec 58, 55p. 29 refs. AFCRC-TN-59-400; AD-216 316.
Order from LC mi$3.60, ph$9.30 PB 143 687

This report discusses the theoretical aspects of a radio wave interaction experiment designed to determine ν (the electron collision frequency), and N (the electron density), as a function of height in the artic D region. The proposed high latitude location of the observations plays an important role in the design of the experiment, which should be capable of providing continuous information on the state of the lower ionosphere in the auroral zone.

Geophysical Inst., U. of Alaska, College.
EXPERIMENT LUXEMBOURG, by G. C. Rumi. Scientific rept. no. 2 on Contract AF 19(604)3880. May 59, 35p. 11 refs. AFCRC-TN-59-471.
Order from LC mi$3.00, ph$6.30 PB 143 686

The present study is concerned with the absorption of radio waves in the D region of the ionosphere. A second section of the paper is devoted to an investigation of the electron collision frequency in the D region. It is deduced that the electron collision frequency in the D region increases during disturbed periods at auroral latitudes.

Naval Research Lab., Washington, D. C.
ATMOSPHERIC TRANSMISSION IN THE VISIBLE REGION, by J. A. Curcio and K. A. Durbin. Final rept. 6 Oct 58, 29p. 12 refs. Rept. 5368.
Order from LC mi$2.70, ph$4.80 PB 140 932

Atmospheric transmission measurements have been made over a period of one year at Washington, D. C., White Sands, New Mexico, and the east coast of Florida. Attenuation coefficients have been determined at three wavelengths (4700A, 5350A, and 6650A) by the Koschmieder contrast relationship, from about 300 sets of visual observations. Measurements were made through a variety of weather conditions including rain, drizzle, snow, and various degrees of haziness. The meteorological range varied from 1.5 to 120 km at a temperature range of 17° to 96°F and the relative humidity varied from 16 to 99 percent. Analysis of the data for the three wavelengths shows that within limits of ±15 percent the following relationship exists for all experimental conditions other than drizzle or rain: attenuation coefficient $\sim$(wavelength)$^{-1.3}$. The White Sands and Florida data are relatively small in number but appear to be similar to the Washington results. The foregoing relationship is in agreement with the particle size distribution function, $dN/d \log r = cr^{-3}$, observed experimentally by Junge. The particle size distribution appears to be independent of relative humidity and attenuation coefficient.

Naval Research Lab., Washington, D. C.
UPPER ATMOSPHERE REPORT NO. 35. GROUND STATIONS FOR NRL ROCKET STUDIES OF THE IONOSPHERE, by J. E. Jackson and G. H. Spaid. 31 Aug 59, 38p. 11 refs. NRL rept. 5342.
Order from OTS $1.00 PB 151 763

Between 1946 and 1958, a total of 23 rocket flights have been instrumented by NRL to measure electron densities in the ionosphere and to investigate various related phenomena. The measurements were based upon the transmission of cw signals from a rocket to receiving and recording stations on the ground. The nature of the experiments required phase comparisons between two harmonically related frequencies.

Since commercial receivers are unsuitable for this purpose, special receiving equipment was designed by NRL scientists to meet the experimental requirements. Particular considerations were given to bandwidth, noise, dynamic range, phase stability, signal-strength metering, and input circuitry. The extremely narrow-bandwidth operation which is possible with the cw method led to the design and use of a new type of crystal filter in the receiving system. The need for separate reception of the ordinary and extraordinary modes of propagation led to a novel adaptation of the magic T at 7.75 Mc. A two-station system, first used at White Sands, New Mexico, was later, during IGY, transferred to Ft. Churchill, Canada. A number of unusually stable, narrow-band rf sweep generators were developed to test, adjust, and calibrate the ground-station equipment. A greatly improved knowledge of the ionosphere at middle and arctic latitudes has resulted from the data acquired at these ground stations.

Naval Research Lab., Washington, D. C.
UPPER ATMOSPHERE RESEARCH REPORT NO. 36. BREAKDOWN AND DETUNING OF TRANSMITTING ANTENNAS IN THE IONOSPHERE, by J. E. Jackson and J. A. Kane. 24 Aug 59, 27p. 20 refs. NRL rept. 5345.
Order from LC mi$2.70, ph$4.80 PB 140 726

Impedance measurements made on a 7.75-Mc rocket-borne antenna during several rocket flights indicate at altitudes above 110 km a capacitance change whose magnitude can be used to determine ambient electron densities. In the 50 to 110 km region the antenna undergoes an rf glow discharge resulting in a severe resistive loading and reduction of radiated power. The properties of this breakdown were investigated both theoretically and by laboratory experiments. The use of a dc bias on the antenna was found helpful in preventing breakdown. The knowledge acquired from this project is being applied to the development of improved rf probe techniques for the direct measurements of electron densities in the ionosphere. (See also PB 151 763)

New Hampshire U., Durham.
A COMPARISON OF THE COSMIC-RAY INTENSITY AT HIGH ALTITUDES WITH THE NUCLEONIC COMPONENTS AT GROUND ELEVATION, by J. C. Henkel, J. A. Lockwood, and J. H. Trainor. Scientific rept. on Contract AF 19(604)1550. [1959] 43p. 25 refs. AFCRC-TN-59-434.
Order from LC mi$3.30, ph$7.80 PB 142 869

New York U. Coll. of Engineering, N. Y.
A CASE STUDY OF THE TROPOPAUSE, by Edward G. Albert. Scientific rept. no. 6 on Contract AF 19(604)1755. July 59, 59p. 18 refs. AFCRC-TN-59-435.
Order from LC mi$3.60, ph$9.30 PB 143 668

From detailed analyses of a warm homogeneous anticyclone it is shown that the generally accepted model of tropopause configuration away from the disturbing influences of fronts and jet streams is untenable. The tropopause is not found to be a smooth and continuous surface of lapse rate discontinuity. A deep tropopause layer containing many such surfaces, some of small horizontal extent, is indicated. Additional analyses, in sub-polar and sub-tropical regions, indicate that this complex type of tropopause layer may extend even into areas where individual soundings show a single, unmistakable tropopause.

Ohio State U. Research Foundation, Columbus.
A DETERMINATION OF THE ABUNDANCE OF NITROUS OXIDE, CARBON MONOXIDE, AND METHANE IN GROUND LEVEL AIR AT SEVERAL LOCATIONS NEAR COLUMBUS, OHIO, by John H. Shaw. Scientific rept. no. 1 on Contract AF 19(604)2259. June 59, 44p. 16 refs. AFCRC-TN-59-428; AD-225 685.
Order from LC mi$3.30, ph$7.80 PB 143 359

Studies of the infrared spectra of long path lengths of air (704 m) permitted determination of the abundances of N_2O, CH_4 and CO in ground level air. The N_2O abundance was estimated as 0.28 ± 0.04 ppm with no seasonal variation detected. Air samples from greenhouses and barns showed an N_2O abundance of 0.33 ± 0.04 ppm. The estimated abundances of CH_4 and CO in ground level air were 2.4 ppm and 1.1 ppm, respectively.

Seismology

Purdue U. Div. of Engineering Sciences, Lafayette, Ind.
RESPONSE TO TALL BUILDINGS TO RANDOM EARTHQUAKES, by A. Cemal Eringen. Technical rept. no. 12 on Contract Nonr-1100(02). Dec 57, 27p. 4 refs. AD-150 640.
Order from LC mi$2.70, ph$4.80 PB 138 182

A method of analysis is given for the calculation of mean square displacements and various correlation functions for a tall building having an arbitrary number of stories. The building is approximated by a series of masses and dashpots, and it is assumed that the mean square displacements of the earth movements are known. Mean square shearing forces and the energy present at each story are evaluated. It is indicated that Rice's formula may be used to calculate the number of times per unit time the random variable (e.g., displacements) will exceed a known, safe value. Computations concerning a ten-story building subject to purely random earthquake process were carried out on an electronic computer and are plotted.

Willow Run Labs., U. of Michigan, Ann Arbor.
WAVES IN LAKE ICE FROM IMPACTS, by D. H. Clements, D. E. Willis, and J. T. Wilson. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Aug 58, 22p. 7 refs. Rept. no. 2144-265-T.
Order from LC mi$2.70, ph$4.80 PB 143 447

A method similar to the standard seismic-refraction techniques was employed for the wave studies. The impacts of falling weights on ice produced a longitudinal plate wave and a dispersive train of flexural waves.

The observed flexural wave dispersion was consistent with theoretical dispersion curves computed from the theory of long flexural waves in an ice sheet in water of a finite depth developed by Ewing and Crary (1934) and Wilson (1955). Three groups of points on the observed dispersion curves obtained from Lake Margrethe data represent flexural waves with frequencies from 2 to 8 cps, 13 to 25 cps and 40 to 140 cps. The first and third groups exhibit dispersion appropriate for the combined thickness of the two-layer floating ice sheet. The second group demonstrates dispersion for a wave path in the upper layer only. Hammer drops on land generate in the layer of frozen ground flexural waves in the frequency range 15 to 40 cps. These waves are transmitted across the lake-shore boundary and follow a wave path in the upper layer of lake ice. The observed flexural wave dispersion curve constructed from propagation data obtained at Garrison Dam, N. D., indicates a single-layer ice sheet. The ice thickness predicted by flexural wave theory is in good agreement with the measured thickness of ice at this site.

ENGINEERING

[Army Chemical Warfare Labs.] Army Chemical Center, Md.
FITTING TRIALS OF E52R23 and E52R24 CIVILIAN PROTECTIVE MASKS, by Robert E. Martin. Interim rept. 10 Sep 53, declassified. 20p. CRLR 249.
Order from LC mi$2.40, ph$3.30 PB 144 208

The civilian protective mask E52R23, which resulted from modifying the E52R18 by adding a temple band, using a thicker headharness, and increasing the number of sizes from four (4) to five (5), was fitted on approximately 400 subjects, including children and adults. Only three (3) subjects were unable to be satisfactorily fitted, these being Negro adults with sloping foreheads who could not be properly fitted even with field protective mask M9A1. Near the end of these tests, the masks E52R23 showed deterioration due to the continuous handling and disinfecting. Of the 115 adult subjects on whom the one size (medium) of the Kimberly-Clark civilian protective mask E52R24 was fitted, an excellent face seal was obtained on all but three (3) subjects. The improper fit on these three (3) subjects was due primarily to the fact that they had small faces and the initial model of this mask was made in only one (1) size.

Aeronautical Engineering

Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TEST OF FIRE EXTINGUISHING AGENTS FOR MAGNESIUM FIRES, by Ralph L. Hough. Mar 59, 21p. 4 refs. WADC Technical note 59-71; AD-212 631.
Order from LC mi$2.70, ph$4.80 PB 144 209

Magnesium and its alloys are frequently associated with aircraft or missile fires. Once ignited the material burns with great intensity and is supported by many materials used in ordinary fire extinguishing agents such as nitrogen, water, carbon dioxide and sulfur dioxide. Tests were conducted on five liquid agents: tricresyl phosphate (TCP), triethylene glycol and orthoboric acid (TEG-H_3BO_3), di-isodecyl phthalate and bromochloromethane in equal parts (DIDP-CB), di-2-ethylhexyl phthalate and bromochloromethane in equal parts (DOP-CB), and tri-methoxyboroxine (TMB). Of the agents tested, DOP-CB proved most effective in extinguishing the flame and inerting the metal so that it could be cooled with water. The mixture provides no handling or storage problems and is not adversely affected by extreme temperatures.

Aeronautical Instruments Lab., Naval Air [Development Center, Johnsville] Pa.
THE CALIBRATION OF CAPACITOR TYPE FUEL QUANTITY GAGES, by C. L. Bartberger. Rept. on Proj. TED NAM AE-7161. 13 Sep 51, 36p. 3 refs. Rept. no. NAES-INSTR-39-51.
Order from LC mi$3.00, ph$6.30 PB 143 433

To establish a standard basis for the calibration of capacitor type fuel quantity gages, with numerical values determined from an analysis of the Armour Research Foundation data on fuel characteristics.

Aeronautical Structures Lab., Naval Air Material Center, Philadelphia, Pa.
DEVELOPMENT OF AUTOMATICALLY ATTENUATED SHAKER EQUIPMENT; M. I. T. MULTIPLE SHAKER SYSTEM, ACCEPTANCE TESTS OF, by R. Friedman and G. Borod. 18 July 50, 69p. 4 refs. Rept. no. ASL NAM-24104.
Order from LC mi$3.90, ph$10.80 PB 143 354

Acceptance and preliminary evaluation tests were conducted on the M. I. T. Multiple Shaker Equipment to determine its suitability for use in exciting natural modes in aircraft structures. The equipment consists of a console, which contains all the necessary power supplies and controls for operating 24 shakers simultaneously, and 30 shakers, pickups and mounting stands. Each shaker has an associated vibration pick-up, the electrical output of which is used both as an aid in selecting the proper excitation and for recording purposes. Included in the console are 24 pick-up attenuator circuits and space for a multichannel oscillograph. The oscillograph itself was not furnished under the M. I. T. contract. The automatic feature of the system is the normalizer, which with the aid of an oscilloscope, enables the operator to apply to any or all 24 shakers a force proportional to the product of an assigned mass and actual vibration amplitude in accordance with the proportionality set up by a master shaker vibrating at or near a resonant frequency of the structure. Results obtained from a vibration survey on a Model SB2C-5 airplane and tests conducted on equipment components are presented.

Aerophysics Co., Washington, D. C.
AERODYNAMIC THEORY OF THE ANNULAR JET, PART I, by Gabriel D. Boehler and Robert J.

Spindler. Rept. on Contracts Nonr-2398(00) and 2747(00). Dec 58, 16/p. 37 refs. Rept. no. AR-581-R.
Order from LC mi$7.80, ph$25.80 PB 143 653

A theory is presented to describe the flow mechanics of air jets issuing from annular openings. Such jets are termed "annular jets". Two configurations are studied: (1) Annular nozzle far from the ground. The jet takes the form of a hollow tulip attached to the orifice of the nozzle and the thrust of the annular nozzle is smaller than that of the corresponding circular nozzle, since it is reduced by the negative pressure on the nozzle base plate resulting from the "jet pump" action of the "two dimensional" viscous laminar or turbulent, incompressible or compressible jet, using a "dividing streamline" concept. A solution of the three-dimensional problem is given in principle; this solution makes use of a Mangler transformation. Calculated base pressures are found to agree fairly well with those found experimentally. (2) Annular nozzle close to the ground. The annular jet, initially vertical, spreads out radially in the horizontal direction, thus creating a region of high pressure air under the nozzle base plate. The thrust of the annular nozzle is now larger than that of the corresponding circular nozzle since it is the sum of the direct jet thrust and of the pressure reaction between the ground and the nozzle base. The variation of the thrust augmentation with the distance from the ground can be explained in terms of simple momentum considerations and fairly good agreement with experimental results is found. The velocity distribution within the curved jet can only be found if viscous effects are introduced; a solution to the viscous problem is sketched in the two-dimensional case. Finally, existing experimental data are briefly reviewed and the parameters which make possible a correlation of these data are pointed out.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE REQUIREMENTS FOR MODIFICATION OF THE HUMAN CENTRIFUGE FOR HIGH PERFORMANCE AIRCRAFT AND SPACE VEHICLE SIMULATION RESEARCH, by Richard J. Crosbie. Rept. no. 3 on Proj. NM 11 02 12.6. 6 July 59, 34p. NADC-MA-5907.
Order from LC mi$3.00, ph$6.30 PB 143 723

Dynamic flight simulation is being conducted on the human centrifuge with gratifying success. The contributions are particularly important in the following areas: pilot tolerance, pilot restraint, cockpit instrumentation, control system design, controllability - with its implication of airframe and engine design, flight techniques including emergency procedures, and pilot training. Preliminary studies indicate that, by a number of modifications to the centrifuge, its capability can be increased.

Bell Helicopter Corp., Fort Worth, Tex.
COST ANALYSIS OF A LIGHT WEIGHT TWO-PLACE OBSERVATION HELICOPTER. Rept. on Contract DA 44-177-tc-420. 27 Oct 57, 33p. Rept. no. D233-099-003; AD-204 372L.
Order from LC mi$3.00, ph$6.30 PB 138 543

Chicago Midway Labs., U. of Chicago, Ill.
DETERMINATION OF FACTORS GOVERNING SELECTION AND APPLICATION OF MATERIALS FOR ABLATION COOLING OF HYPERVELOCITY VEHICLES, by John H. Bonin, Channon F. Price, and Donald E. Taylor. Rept. for 1 Dec 57-30 Nov 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5436. July 59, 142p. 6 refs. WADC Technical rept. 59-87, Pt. 1; AD-226 829.
Order from OTS $2.75 PB 161 090

The report includes the results of an investigation for which the prime objective was the determination of the behavior of materials exposed to thermal environments representative of re-entry conditions. The environment encountered by ballistic, glide, and skip vehicles is reviewed. Heat flow into single and composite slab materials for heat sink applications is discussed. The development and calibration of an air-stabilized arc facility of a nominal 1000-KW rating is described. In the experimental phase of the investigation, representative materials were exposed to the high-temperature plasma discharge produced in stabilized arcs. The results obtained are reported upon, along with a correlation of the observed behavior with theory.

Convair, Fort Worth, Tex.
ACTIVATION HANDBOOK FOR AIRCRAFT DESIGNERS, REVISED. Rept. on [Contract AF 33(600)32054]. 30 Sep 57, 407p. 19 refs. ANP Doc. no. NARF-57-50 T; FZK-9-124.
Order from LC mi$11.10, ph$62.10 PB 144 269

This revision is intended to furnish the aircraft design engineer with a readily accessible reference source for the underlying theory, the necessary nuclear data, and the analytical techniques required in the practical analysis of the neutron induced activation of aircraft materials functioning in a nuclear environment.

Courtney and Co., Philadelphia, Pa.
HUMAN FACTORS IN AIR TRAFFIC CONTROL SYSTEMS DESIGN, by Kenneth W. Colman, Douglas Courtney, and Wallace W. Wallace. Summary rept. on Contract Nonr-2346(00). 1 Dec 58, 53p. Rept. no. 24.
Order from LC mi$3.30, ph$7.80 PB 143 930

The organization of this report follows the natural phases into which the work was divided: Chapter Two Phase I describes the work performed in support of the Air Navigation Development Board and the CAA Technical Development Center, while Chapter Three Phase II describes the human factors effort carried out in support of the Airways Modernization Board.

David Taylor Model Basin, Washington, D. C.
COMPARISON OF EXPERIMENTAL AND THEORETICAL DESIGN PARAMETERS OF A 6-INCH-DIAMETER ANNULAR JET MODEL WITH A JET ANGLE OF -45° HOVERING IN PROXIMITY TO THE GROUND; AND EXPERIMENTAL RESULTS FOR FORWARD FLIGHT AT ZERO ANGLE OF ATTACK, by Anibal Alfredo Tinajero. May 59, 68p. 5 refs. Aero rept. 954.
Order from LC mi$3.90, ph$10.80 PB 143 574

The results of static and dynamic tests of a 6-inch-diameter "annular jet" model with a jet angle of -45° and at zero angle of attack are presented. Experimental values are compared with the theoretical results available for the static condition. The effects of ground proximity upon the aerodynamic characteristics were investigated. Lift, drag, and pitching-moment coefficients were determined. The "annular jet nozzle" was found to be highly effective as a lift producer. It was found that the lifting property that exists in the static configuration at low pressure ratios decays with increasing forward speed. At the higher pressure ratios the loss is still great at very low forward speeds, but there is some recovery as the speed is increased.

Diamond Ordnance Fuze Labs., Washington, D. C.
RADIO COLLISION AVOIDANCE SYSTEMS FOR AIRCRAFT, by R. T. Fitzgerald, H. C. Brown and M. D. Reed. 15 Sep 59, 52p. 10 refs. TR-744.
Order from OTS $1.50 PB 161 119

Several cooperative radio systems for avoiding aircraft collisions are considered from the standpoints of technical requirements, feasibility, and cost. The system with the broadest potential application is selected. In basic form, the selected system utilizes the upper UHF region to communicate altitude and heading information, and vertical maneuvers are defined by the altitude information. In expanded form this system determines relative bearing and heading, to predict collision hazard in both the vertical and horizontal planes. Potentially, a reduction in unintentional collisions of 100:1 can be achieved with the selected approach. The applicability of this system to collision avoidance problems of military, commercial, and private aircraft, and to related problems of navigation and air traffic control is outlined.

Gyrodyne Co. of America, Inc., St. James, N. Y.
PRELIMINARY DESIGN STUDY OF OPTIMUM ARMY TWO-PLACE OBSERVATION HELICOPTER, by Edward W. Strong. Final rept. on Contract DA 44-177-tc-419. Aug 57, 213p. 25 refs. Rept. no. RD46-310000-1; AD-207 276.
Order from LC mi$9.60, ph$33.30 PB 138 544

A study has been conducted to arrive at the design of the optimum Army two-place observation helicopter for use in the 1960-70 decade. Of the configurations considered, the coaxial type and the single rotor-tail rotor type have been found to be the most suitable. A detailed comparative evaluation of these two configurations indicates that the coaxial type offers a much greater degree of fulfillment of the characteristics desired by the Army than does the single rotor-tail rotor type. The design selected as optimum-namely a coaxial rotor type incorporating two two-bladed semi-rigid coaxial rotors, powered by a 250 horsepower turbine engine (final version) and/or a Lycoming VO-360 reciprocating engine (interim version) - is described. The design of the proposed two-place helicopter is based very closely upon that of the Model XRON-1 Rotorcycle (one-man helicopter).

Hiller Aircraft Corp., Palo Alto, Calif.
STATIC LIFT CHARACTERISTICS OF JET SLOTS: A CLARIFYING STUDY OF THE EXTERNAL EJECTOR, by M. F. Gates. Final rept. on Contract Nonr-2428(00). 15 Oct 58, 95p. 29 refs. Rept. no. ARD 213.
Order from LC mi$5.40; ph$15.30 PB 143 229

The external ejector utilizing a surface profile developed by Cornell Aeronautical Laboratory was evaluated in both two-dimensional and three-dimensional configurations for the purpose of defining the thrust augmentation potentialities of this phenomenon in an attempt to end a controversy that has existed for a number of years. The results of the program, the recent work of NACA and the almost unanimous conclusions of other reviewed work indicate that static thrust augmentation is not possible with the external ejector. It was found however, that ideal turning efficiencies as high as 88% are possible with this extremely simple hardware. In both two-dimensional and three-dimensional configurations, the turning efficiency increased with increasing nozzle slot height (σ) which was terminated by breakaway in the two-dimensional tests and by insufficient air supply in the three-dimensional tests. Performance data and surface pressure surveys are presented for both configurations. Flow visualization by means of smoke streams is discussed.

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by Glen N. Rardin. Interim engineering rept. no. 1 for 18 Oct 57-28 Feb 58 on Contract AF 33(600)35543. 28 Feb 58, 192p. 79 refs. LR-12970; AD-156 722.
Order from OTS $3.00 PB 161 271

This report covers the first phase of an investigation into the application of high rates of energy to the forming of materials difficult or impossible to form by conventional means. A thorough literature survey has been made of the theoretical differences between statically and dynamically applied loads. Twenty-seven organizations were contacted to determine the level of knowledge extant. Their methods of applying high velocity energy and high hydrostatic pressures have been examined and reported.

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by Glen N. Rardin and A. F. Watts. Interim engineering rept. no. 2, 1 July-30 Sep 58, on Contract AF 33(600)35543. [1958] 54p. 37 refs. LR-13350.
Order from OTS $1.50 PB 161 272

This report describes the facilities that have been constructed, the design and manufacture of the tooling, preparation of the materials, and the instrumentation required to conduct forming tests. (See also PB 161 271)

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by Glen N. Rardin and A. F. Watts. Interim engineering rept. no. 3, 1 Oct-31 Dec 58, on Contract AF 33(600)35543. [1958] 43p. LR-13435.
Order from OTS $1.25 PB 161 273

The program deals with open die forming in air and water, employing a steel die to produce a 2.5 inch diameter hemisphere with a draw radius of .25 inches. The material used throughout this phase was Vascojet-1000 in the annealed condition, 5.75 inches in diameter, 0.025 inches thick. (See also PB 161 272)

Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING, by A. F. Watts and Glen N. Rardin. Interim technical engineering rept. no. 5 for 1 Apr-30 June 59 on Contract AF 33(600)35543. [1959] 268p. 54 refs. LR-13873; AD-225 601.
Order from OTS $4.00 PB 161 274

The result of forming tests on two steel and two titanium alloys using high explosives is presented. Measurements of strain rates, velocities and temperatures together with the metallurgical effects of materials subjected to high strain rates are given. Although forming sheet materials with high explosives offers decided advantages in certain areas, within the limits of the test procedure there was no evidence of increased elongations as a result of increased strain rates or pressures. (See also PB 151 849)

Martin Co., Baltimore, Md.
ANALYSIS OF WIND TUNNEL TEST RESULTS OBTAINED FOR A PROPELLER-POWERED MODEL WITH FLAP BLOWING, by Milton A. Schwartzberg and Theodore E. Challberg. Rept. on Contract NO a(s) 56-311C. 30 Aug 57, declassified 2 July 58, 176p. 25 refs. Engineering rept. no. 9429.
Order from LC mi$8.10, ph$27.30 PB 143 603

A wind tunnel test has been conducted of a propeller-powered model seaplane with high-speed air blown over the trailing-edge flaps. The configuration had a high-mounted, aspect ratio 10 straight wing, a high fineness ratio hull and a T-tail. The wing mounted a full-span, 25-percent chord plain flap with blowing momentum coefficients up to 1.2. Power was simulated for four inboard propeller engines at thrust coefficients up to 0.7 per engine. The test results are presented in David Taylor Model Basin wind tunnel report No, 919 (Ref. 7). These results have been analyzed in the present report. The analysis of the test results is concerned with the effects on lift, drag and pitching moment of propeller power, flap blowing and combined power and blowing. The effect of these parameters on the dynamic pressure ratio and downwash at the tail as well as the stabilizer incidence required to trim the configuration were also determined. Some effects of the presence of a ground are noted. In the course of the analysis, it has been possible to devise methods for predicting some of the effects of propeller power and flap blowing on a general airplane configuration. These methods are presented for consideration and future application.

Massachusetts Inst. of Tech., Cambridge.
AN EXPERIMENTAL STUDY OF THE FLOW FIELD ABOUT SWEPT AND DELTA WINGS WITH SHARP LEADING EDGES, by Ivan Jaszlics and Leon Trilling. Rept. on Contract AF 18(600)1306. Oct 57, 54p. 16 refs. Fluid Dynamics Research Group rept. no. 57-4; AFOSR Technical [rept.] no. 58-6; AD-157 948.
Order from LC mi$3.60, ph$9.30 PB 144 067

A series of experiments was performed to define the flow field on the upper surface of high aspect ratio swept wings and narrow delta wings at high angles of attack. It was found that near the root section of either type of wing, the flow is conical. The edge of the vortex sheet which originates at the leading edge is a straight line whose position relative to the leading edge depends only on incidence. On swept wings, the vortex edge turns downstream as soon as the vortex sheet covers the front half of the wing chord, and the flow under the vortex sheet outboard of that turning point is uniform and parallel to the leading edge of the wing. On narrow delta wings, the conical symmetry persists almost to the trailing edge.

National Research Labs., Ottawa (Canada).
PRESSURE DISTRIBUTION AND FORCE MEASUREMENTS ON A VTOL TILTING WING-PROPELLER MODEL. PART I. DESCRIPTION AND TABULATED RESULTS, by J. A. Dunsby, M. M. Currie and R. L. Wardlaw. June 59, 52p. 7 refs. Aeronautical rept. LR-252.
Order from LC mi$3.60, ph$9.30 PB 143 579

This report presents tabulated results of pressure and force measurements on a half wing model of a twin-engined tilt-wing VTOL configuration over a range of thrust coefficient for a limited range of incidence.

Ohio State U. Research Foundation, Columbus.
A SURVEY OF FLIGHT-LINE HAND SIGNALS, by Henry M. Moser, John J. O'Neill and others. Technical note no. 51 on Contract AF 19(604)1577. Sep 58, 26p. 20 refs. AFCRC TN-58-57; AD-160 705.
Order from LC mi$2.70, ph$4.80 PB 138 776

This report is essentially a collection and preliminary survey of hand signals used by flignt line personnel. Two Air Force publications were used as pictorial and descriptive sources and visits were made to an Air Force Base, a Naval station, and an aircraft factory. Photographs were taken of hand signals previously represented in publications by drawings. Modifications of these signs, new signs, and variations on the signs by a deaf man are also shown in photographs. Recommendations are made for further surveys and a pocket manual of photographed signs.

Quick, A. W.
OSCILLATIONS IN AXIAL-FLOW COMPRESSORS, by H. Söhngen and A. W. Quick. Scientific rept. no. 2 on Contract DA 91-508-EUC-298. 25 Apr 59, 38p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 143 455

It will be shown that in the case of blade oscillations in axial-flow machines the compressibility of the fluid, however small the flow speeds may be, is of vital importance.

Rensselaer Polytechnic Inst., Troy, N. Y.
ON THE THRUST HYPOTHESIS FOR THE JET FLAP INCLUDING MIXING EFFECTS, by K. T. Yen. Rept. on Contract AF 49(638)23. June 59, 37p. 11 refs. TR AE-5902, AFOSR-TN-59-737.
Order from LC mi$3.00, ph$6.30 PB 143 159

This paper is concerned with the thrust generated by a jet flap. It is shown that a "linear" thrust hypothesis can be obtained, provided linearized potential flow is assumed. In fact, the linearized problem of a jet flap system is found to be the linear combination of a lift problem and a thrust problem. The lift problem gives all the lift generated, but it is of interest to note that the thrust problem would yield all the thrust developed by the jet flap within the limitation of the linearized theory. The mixing of the jet flap with the surrounding fluid is analyzed by the momentum integral method. The analysis substantiates Stratford's suggestion for obtaining an increase of thrust by causing the jet to mix with the main stream in a region of high suction. Finally, some approximate formulas, relating the thrust and the jet angle, are derived. The drag of the airfoil section and other viscous effects are, however, not considered.

Soundrive Engine Co., Los Angeles, Calif.
STUDY OF INTERNAL ACOUSTIC ABSORBERS AS A TECHNIQUE FOR TURBOJET ENGINE NOISE REDUCTION: DATA, by D. A. Bies, J. H. Caffrey, and O. B. Wilson, Jr. Final rept. on Contract NOas-55-541-c. Aug 57, 167p. Rept. no. 94.
Order from LC mi$7.80, ph$25.80 PB 138 868

Southern Calif. Labs., Stanford Research Inst., South Pasadena.
PRESENT STATUS OF THE FUTURE OUTLOOK FOR ALL-METAL SANDWICH CONSTRUCTION FOR AIR VEHICLES, by William A. Tweedie, Peter D. Tilton and Redford C. Rollins. Rept. on Contract NOas-59-4264-f. Aug 59, 148p. 69 refs. SRI Proj. no. IU-2932.
Order from OTS $2.75 PB 161 099

The information presented in this report has been drawn from a wide variety of sources and has been supplemented by extensive field investigations by the Institute's project team. Although every attempt has been made to obtain and present the most reliable data, it is possible that the rapid pace of technological development may have introduced certain changes since the conduct of the study and the preparation of the report. In making this study, the Institute's project team held discussions with manufacturers of both core and panels and with the major contractors in the aircraft industry under BuAer cognizance. In certain instances, other aircraft manufacturers were contacted when it was known that development work was under way on core panel construction or that specific design dictated the use of low-density core panel components. Section II of this report summarizes the findings of the research. Since a study of honeycomb requires some familiarity with airframe design requirements and applications, Section III provides a resumé of information on this subject. Section IV and V are concerned with the manufacture of welded honeycomb core and low-density core panels, respectively. Section VI provides a discussion of quality control, and Section VII is concerned with testing and inspection. Section VIII presents a projection of the estimated requirements for honeycomb core and core panels and an estimate of the industry's capability to produce these requirements.

Vertol Aircraft Corp., Morton, Pa.
FEASIBILITY STUDY OF HELICOPTER RANGE EXTENSION USING FLOATING WING FUEL TANKS, by C. B. Fay. Rept. on Proj. no. 9-38-01-000 ST801 Contract DA 44-177-tc-478. 28 Sep 58, 88p. 9 refs. Rept. R-156; AD-203 262.
Order from LC mi$4.80, ph$13.80 PB 142 950

This report presents the results of an engineering analysis of floating wing fuel tanks as a means of helicopter range extension. Both single and tandem rotor helicopters of current operational types are considered. The floating wing concept is one in which the wing supports the required fuel for the ferry mission while the helicopter provides the propulsive force to overcome the wing drag. The wing is attached to the helicopter through a skewed horizontal hinge. Calculations of wing parameters and characteristics were based on 1200 and 2400 nautical mile range missions for both the VERTOL H-21 and Sikorsky H-34 helicopters. The results of the study show that the concept is feasible and that the structural modification of the basic helicopter using the floating fuel-wing kit is minor.

Civil Engineering

Brown U. Div. of Engineering, Providence, R. I.
ENGINEERING RESEARCH IN SOIL MECHANICS WITH EMPHASIS ON STRESS-STRAIN RELATIONS AND SOLUTIONS BASED ON SIMPLE THEORY, by Daniel C. Drucker. Final technical rept. on Contract DA-19-020-ORD-3703. 31 Mar 58, 2p. 1 ref. AD-157 858.
Order from LC mi$1.80, ph$1.80 PB 138 587

Bureau of Yards and Docks, Washington, D. C.
DREDGING. 1 July 53, 50p. Technical Pub. NAVDOCKS TP-Pw-19.
Order from OTS $1.25 PB 161 254

This publication serves as an introduction to the subject of dredging and is provided for personnel concerned with dredging operations. These operations include: (a) providing and maintaining channels, anchorages, turning basins, and slips used primarily by Navy vessels, where suitability for use by commercial craft is only incidental; and (b) providing material for aggregate or for filling low areas. Part A presents the Bureau's policies and responsibilities for dredging operations and facilities, and defines terms relating to the subject of dredging. Part B describes the various kinds of dredges, submerged-rock-removal equipment, dump scows, pontoons, and

pipe lines. Part C outlines dredging operations and deals with the objects of dredging, preliminary engineering involved, the handling of dredging equipment, and subsurface rock removal.

Massachusetts Inst. of Tech., Cambridge.
FEASIBILITY STUDY CONCERNING THE UTILIZATION OF PLASTICS FOR UNDERGROUND PERSONNEL SHELTERS, by Denis A. Blackett and Saul Namyet. Rept. on Contract NBy-3150. Sep 59, 144p. 33 refs.
Order from LC mi$7.20, ph$22.80 PB 143 895

An investigation is made into the feasibility and practicability of using plastic materials for the structural components of underground personnel shelters. It is found that fiberglass reinforced plastic is the only suitable, presently available plastic material. The general nature of underground structural behavior is investigated and it is found that curvilinear surfaces having at least one radius of positive curvature are the best shelter shapes. Doubly-curved or warped surfaces are recommended for underground shelter purposes. Certain aspects of underground load-response phenomena are investigated. Design procedures are developed for various structural types and cost data obtained. Brief recommendations concerning future research and development are presented.

Electrical and Electronic Engineering

Air Force Cambridge Research Center, Bedford, Mass.
OFF-AXIS SIDELOBE REDUCTION IN ELLIPTIC TORUS REFLECTORS, by William G. Mavroides and Joseph H. Provencher. Dec 58, 15p. 5 refs. AFCRC-TR-58-199; AD-160 758.
Order from LC mi$2.40, ph$3.30 PB 142 802

A three-horn primary feed used with an elliptic torus effectively reduces undesirable sidelobes. Patterns and contour plots show a reduction of 8 to 14 db in sidelobe level while the beamwidth remains essentially unchanged.

Air Force Cambridge Research Center, Bedford, Mass.
TECHNIQUES FOR AIR CONTROL SYSTEM APPLICATIONS, by Thomas C. North, George Harpell and others. July 59, 38p. AFCRC-TR-59-165.
Order from LC mi$3.00, ph$6.30 PB 143 966

During the development of the Tactical Air Control System at AFCRC several techniques that were found feasible were not put into the production model, but it was felt that they were of sufficient value to warrant being made a matter of record. Four of these efforts are described in this report. The passive coincidence circuit was designed to aid the prediction of collisions when used with an iterative display computer, such as SAINT. The optical analog-to-digital converter (optical digitometer) was originated to read the outputs of a time-sharing analog intercept computer. The two-speed joystick was an attempt to simplify the manual assignment operation in the tracking console, CARTRAC. The electronic switch was built to switch dc analog tracking voltages to permit tracks to be labeled.

American Machine and Foundry Co., Boston, Mass.
RECEIVER INDICATOR FOR A LONG RANGE DISTANCE MEASURING SYSTEM. Final engineering rept. on Contract AF 30(602)668. 20 June 57, 93p. AMFED Ref. no. 262-9; RADC-TR-57-134; AD-131 214.
Order from LC mi$5.40, ph$15.30 PB 144 020

A receiving and range-measuring equipment which will furnish distance information in rho-rho form with respect to fixed ground stations was constructed to test the practicability of a system which operates on the principle of the phase shift of a received signal as a function of the distance between the receiver and the transmitter. The development of this equipment indicated the feasibility of an equipment designed to measure the phase of a received signal and compare it with the phase of a locally generated signal. The operation of the system in the laboratory proved satisfactory. The evaluation of field data was suggested to determine the value of the rho technique for use in a long-range navigation system.

Armed Services. Electro-Standards Agency [Fort Monmouth, N. J.]
ARMED SERVICES INDEX OF R. F. TRANSMISSION LINES AND FITTINGS. 1 Apr 59, 292p. ASESA 49-2B; NAVSHIPS 900-102B.
Order from LC mi$11.10, ph$45.60 PB 143 816

[Army Signal] Radio Propagation Agency, Fort Monmouth, N. J.
ANALYSIS AND PREDICTION OF SKY-WAVE FIELD INTENSITIES IN THE HIGH FREQUENCY BAND, by Paul O. Laitinen and George W. Hayden. Aug 50, reprinted Mar 56. 132p. 16 refs. Technical rept. no. 9.
Order from LC mi$6.90, ph$21.30 PB 143 141

The purpose of this report is to present an engineering method of evaluating sky-wave field intensities in the high frequency band for any transmission distance up to about 15,000 kilometers. Field intensity recordings were statistically analyzed in order to study daytime absorption, day-to-day variations, and absolute magnitudes. Based upon the analysis, a proposed prediction method was obtained which should give relatively accurate sky-wave field intensities for the frequencies and distances considered. Succeeding sections show the method of analysis of absorption, the method of analysis of absolute magnitudes, the method of analysis of day-to-day variations, the proposed field intensity prediction method, and summarizing conclusions. All necessary equations used in the prediction method are represented in nomograms.

Army Signal Radio Propagation Agency, Fort Monmouth, N. J.
LONG-TERM PREDICTIONS OF GEOMAGNETIC DISTURBANCES AND THEIR EFFECTS ON RADIO COMMUNICATIONS, by Luther C. Kelley. Nov 58, 40p. 10 refs. Proj. no. 636A.
Order from LC mi$3.00, ph$6.30 PB 143 138

This report forewarns supervisory and operating personnel of increased radio circuit outage during the downward trend of the current sunspot cycle. Long-range predictions indicate that severe disruptions of radio service will result from geomagnetic or ionospheric storms during this period. Data of actual circuit performance illustrate the curtailment of radio communication with rising geomagnetic activity. Long-term forecasts are based on the correlation between geomagnetic activity and sunspot number observed for many years. Recommendations for the reduction of outage are made. A general discussion is included.

Army Signal Radio Propagation Agency, Fort Monmouth, N. J.
OTHER-THAN-CO-CHANNEL INTERFERENCE WITH RESPECT TO TROPOSPHERIC SCATTER COMMUNICATION. PART A: CONSTANT BARELY AUDIBLE SIGNALS, by Sol Perlman, William J. Russell, Jr. and William D. Stuart. May 58, 157p. 26 refs. Proj. no. 646.
Order from LC mi$7.50, ph$24.30 PB 143 140

Mutual interference between "Forward Propagation by Tropospheric Scatter" ("FPTS") circuits and other communication circuits is examined for other-than-co-channel intrusions. The first sections and the Appendix of the report define the various types of interference and briefly analyze their causes and remedies. In a later section certain interim assumptions are proposed concerning measures of the interference threshold signal strength at the inputs to the affected receivers. For the various antennas, frequencies, and azimuths examined, tabulated values are presented of the distances of separation between the receivers and the sources of interference required to satisfy these assumptions. Recommendations include possible means of reducing the interference and measurements that should be taken to enable the interference to be predicted more accurately. A supplement is included covering co-band interference at 2000 Mc and second harmonic interference from 1000 Mc "FPTS" equipment.

Army Signal Radio Propagation Agency, Fort Monmouth, N. J.
TENTATIVE EVALUATION OF TRANSMISSION FACTORS FOR SPACE VEHICLE COMMUNICATION, by Luther C. Kelley, Sol Perlman and others. Sep 58, 145p. 88 refs. Proj. no. 664.
Order from LC mi$7.20, ph$22.80 PB 143 142

With the increased use of space vehicles a study of the various propagational and equipment factors affecting space vehicle communication is needed. This report makes a preliminary evaluation based on theoretical considerations and the limited experimental evidence from the existing satellites, moon-radar experiments, and radio astronomy measurements. The optimum frequencies for the varied needs of space vehicle communication can best be determined from estimated system performance. A discussion is given of the noise limitations, equipment limitations, proper choice of earth station locations and the other factors that affect the signal-to-noise ratio at the receiver. Some of the newer technical developments that increase sensitivity to weak signals are evaluated for their potential increase in distance of communication. Some consideration is given to the effects of the ionosphere including absorption, angle errors, Faraday rotation of polarization, meteor trail interference, and auroral interference and to the effects of oxygen, water vapor, and other gases that cause absorption, angular deviation, and noise. Included is a selection of the better frequencies for line-of-sight and for over-the-horizon communication with space vehicles and the frequencies that would be less subject to mutual interference with earth stations for communication between vehicles. A discussion is given of the advantages of elevated locations for communication with space vehicles including "hovering" ones.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
DESIGN TECHNIQUES FOR STRIP LINE DIRECTIONAL COUPLERS AND RESONATORS, by Isaac Abeyta. 10 June 57, 36p. 9 refs. Technical memo. no. M-1893.
Order from LC mi$3.00, ph$6.30 PB 142 809

Because of their outstanding characteristics, two of the components treated under this program deserve special consideration from the standpoint of user and designer. The two items are coupled strip-line directional couplers and resonators. It is the purpose of this memorandum to point out some of the outstanding characteristics, suggest possible applications, and present the necessary design information. The design information is, of course, available in the various SRI progress reports, however, as presented in this memorandum the designer interested in final results will find it unnecessary to digest the SRI research work before he can design either of these components. This memorandum will also serve as a summary for those who do not have the time to follow the detailed analysis carried out by SRI but who are nonetheless interested in forming an idea of what can be achieved with these components.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
RECENT ADVANCES IN SOLID STATE RECEIVERS by Wesley G. Matthel. 15 Oct 58, 29p. 29 refs. USASRDL Technical rept. 1993.
Order from LC mi$2.70, ph$4.80 PB 143 352

With new variable reactance semiconductor diodes, ferrites, and maser materials and techniques, broadband and narrow-band receivers have been built up to X-band frequencies with effective noise temperatures less then 200°K. The relative importance of these various types of solid state receivers and their future possibilities are presented.

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth and D. L. Goldwater. Scientific rept. no. 5 on Contract AF 19(604)3904. 15 July 59, 47p. 5 refs. AFCRC-TN-59-577.
Order from LC mi$3.30, ph$7.80 PB 143 683

In a program of development of thorium impregnated tungsten matrix cathodes life studies have been extended to 6000 hours at 1 amp/cm^2, at approximately 1550°C_B, and 3500 hours at 2.4 amps/cm^2 at approximately 1620°C_B, both life figures subject to upward revision as tests continue. An experimental determination of preliminary character has been made of the surface density of thorium on tungsten corresponding to the emission maximum. Relevant to studies concerning the possibility of desorption of thorium by electron bombardment, work is in progress regarding thermal deactivation (evaporation) rates as a function of temperature and coverage. Experiments are described concerning "knife-edge" seal techniques for dry box closure of experimental tubes which must thereafter have extensive baking. (See also PB 142 293)

Battelle Memorial Inst., Columbus, Ohio.
EXPERIMENTAL ANALYSIS OF PERFORMANCE OF GALVANOMAGNETIC AMPLIFIERS, by R. K. Crooks, G. J. Falkenbach, and T. S. Shilliday. Final rept. on Contract AF 30(602)1839, 15 July 59, 79p. 24 refs. RADC TR-59-119, AD-220 116.
Order from LC mi$4.50, ph$12.30 PB 142 934

This investigation is concerned with the theoretical and experimental analysis of the performance of galvanomagnetic amplifiers, especially the magnetoresistance amplifier, with verification of the analysis by laboratory investigation. Particular emphasis is placed on consideration of amplifier gain, impedance level, noise, bandwidth, and power-handling capabilities. Expressions for amplifier gain are developed and are verified experimentally for the magnetoresistance amplifier. Gain is shown to be a function of the d-c power dissipated in the semiconductor element, the mobility of the majority carriers in the element material, the magnetic bias on the element, and the efficiency of the input circuit in establishing the necessary a-c magnetic-flux density in the element.

Bell Telephone Labs., Inc. [Whippany, N. J.]
AN ULTRA-PRECISE STANDARD OF FREQUENCY, by R. A. Sykes. Interim rept. no. 1 for 12 July-12 Oct 56 on Contract DA 36-039-sc-73078. 21 Nov 56, 39p. 4 refs. Rept. no. 27480.
Order from LC mi$3.00, ph$6.30 PB 143 348

A preliminary analysis has been made of the behavior of quartz crystal units over a wide range of frequencies at very low ambient temperatures, and some experimental results are given for the temperature coefficient and Q as a function of temperature. An analysis is made of the effects on frequency resulting from variations in circuit reactances and tube-gain characteristics for two kinds of oscillators, with a comparison of the theoretical stability limitations of both types.

Bliley Electric Co., Erie, Pa.
SERVICE, FACILITIES AND MATERIALS TO CONDUCT RESEARCH AND INVESTIGATION INTO THE ORIGIN OF ACTIVITY DIPS IN THE RESPONSE OF AT CUT LOW FREQUENCY RESONATORS, by J. M. Wolfskill and R. H. Tuznik. Progress rept. no. 6 for 15 Mar-15 June 56 on Contract DA 36-039-sc-63105. [1956] 69p.
Order from LC mi$3.90, ph$10.80 PB 143 347

Bliley Electric Co., Erie, Pa.
SERVICES, FACILITIES, AND MATERIALS TO DESIGN AND DEVELOP HIGH SHOCK AND VIBRATION RESISTANT CRYSTAL UNITS IN THE FREQUENCY RANGE 200kc TO 500kc, by J. M. Wolfskill and R. H. Tuznik. Quarterly progress rept. no. 1 for 1 Jan-30 Apr 57 on Contract DA 36-039-sc-73148. [1957] 78p, AD 134 499
Order from LC mi$4.50, ph$12.30 PB 143 351

Testing and evaluation of the performance of standard type CR-26/U crystal units under shock and vibration conditions. Techniques, methods, and materials used in the manufacture of these standard units. Failure of these standard units under the conditions of the vibration test makes necessary a new type support structure to remedy the defects. Design considerations involved in meeting these new requirements are included.

Bliley Electric Co., Erie, Pa.
SERVICES, FACILITIES AND MATERIALS TO DESIGN AND DEVELOP HIGH SHOCK AND VIBRATION RESISTANT CRYSTAL UNITS, by J. M. Wolfskill and R. H. Tuznik. Quarterly progress rept. no. 2 for 1 May-30 Sep 57 on Contract DA 36-039-sc-73148. [1957] 31p.
Order from LC mi$3.00, ph$6.30 PB 143 034

Selection of an optimum "cut" in these 455 kc/s units, and performance of both "CT" and "DT" blanks in the ceramic frame symmetrical "H" supporting structure. The support structure design in experimental models eliminates significant resonances during the vibration spectrum from 10 to 2,000 cps.

Bureau of Yards and Docks, Washington, D. C.
BASIC ELECTRICAL ENGINEERING. CHAPTER 1. WIRE COMMUNICATION AND SIGNAL SYSTEMS. 15 Sep 55, 116p. 21 refs. Technical Pub. NAVDOCKS TP-Te-5.
Order from OTS $2.50 PB 161 253

This Technical Publication, which consists of four chapters, provides guidance to Bureau and field personnel responsible for the design, installation, maintenance, and operation of wire communication and signal systems, interior lighting and power facilities, lighting and cathodic protection, and suppression of radio interference at naval shore activities. The general introduction presents the authority and general responsibilities of this Bureau for the above-named phases of public works and public utilities operations. Chapter 1 is concerned with wire communication and signal facilities, including detailed criteria on all aspects of telephone installations.

Bureau of Yards and Docks, Washington, D. C.
BASIC ELECTRICAL ENGINEERING. CHAPTER 2. LIGHTING AND POWER SYSTEMS. CHAPTER 3. LIGHTNING AND CATHODIC PROTECTION. CHAPTER 4. ELECTROMAGNETIC INTERFERENCE SUPPRESSION. Rev. 26 June 58, 106p. Technical Pub. NAVDOCKS TP-Te-5; BuDOCKSINST 11000.12A.
Order from OTS $2.50 PB 161 256

Chapter 2 presents engineering criteria on (a) lighting and power systems inside buildings and structures and (b) street-lighting systems. Chapter 3 deals with (a) lightning protection methods and systems and (b) cathodic protection for underground and aboveground installations. Chapter 4 deals with the methods and systems used for suppression of electromagnetic interference from electrical sources. (See also PB 161 253)

Bureau of Yards and Docks, Washington, D. C.
POWER GENERATION AND DISTRIBUTION. CHAPTER I. ELECTRIC POWER GENERATION.
15 Sep 54, 194p. 34 refs. Technical Pub. NAVDOCKS TP-Pu-3; BUDOCKSINST 11310.9.
Order from OTS $3.00 PB 161 252

This Technical Publication, which consists of nine chapters, provides guidance to Bureau and field personnel responsible for the design, installation, maintenance, and operation of power generating plants and distribution systems at naval shore activities. The general introduction for this series of publications presents the general authority of this Bureau for power facilities. Chapter 1 deals with the major phases of electric power generation. The first part of the chapter discusses the design of steam generating plants, fuels, boilers and accessories, boiler feed, methods of firing, combustion control systems, and the generation of electric power by steam turbine. The last part of the chapter is concerned mainly with operation and maintenance of steam generating plants but also includes the essential plant elements for the generation of electric power by internal combustion engine.

California U., Los Angeles.
TRANSFORMS FOR LINEAR TIME-VARYING SYSTEMS, by John A. Aseltine. Rept. on Contract N6onr-275(16). Feb 52, 112p. 36 refs. Dept. of Engineering rept. 52-1; ATI-196 326.
Order from LC mi$6.00, ph$18.30 PB 144 286

This paper presents a method for finding an integral transformation appropriate for a given linear time-varying system. The method makes possible analysis and synthesis of certain time-varying systems through the use of transform tables and associated theorems. Although the method is not restricted to a particular kind of time-varying physical system, examples center around electrical circuits.

Case Inst. of Tech., Cleveland, Ohio.
SOLID ANGLE SYNTHESIS, by Robert Plonsey. Scientific rept. no. 7 on Contract AF 19(604)3887. 17 Aug 59, 61p. 16 refs. AFCRC-TN-59-595.
Order from LC mi$3.90, ph$10.80 PB 143 661

This paper discusses synthesis of solid angle antenna patterns by means of planar aperture or array distributions. The available techniques for one dimensional pattern synthesis (in particular that based on Fourier analysis, and methods due to Woodward and to Ruze) are applied to the two dimensional case. A discussion of antenna Q and its evaluation is given for an aperture with uniform source polarization. An approximation to the Q for a class of arrays is also given. Several optimization criteria are discussed for this problem, and the various techniques compared.

Centro Radioelettrico Sperimentale "G. Maroni", Rome (Italy).
H. F. BACKSCATTER FROM LAND AND SEA, by I. Ranzi and P. Dominici. Scientific note no 1 on Contract AF 61(052)139. 30 May 59, 7p. 6 refs. AFCRC-TN-59-574.
Order from LC mi$1.80, ph$1.80 PB 143 642

The recordings of the backscattered echoes, performed since August 1957 on the frequencies of 18.6 and 22.3 Mc/s, in the station of Torrechiaruccia (42.03^{o} N, 11.84^{o} E), show an azimuthal distribution in the backscatter intensity, with maxima on the sea and minima on the land. This result is examined in the light of the observations of echoes directly backscattered from the sea at a short distance. The importance of the knowledge, concerning the dependence of the backscatter coefficient on the nature of the ground and on other eventual conditions, is emphasized especially for the solution of the problems about the protection of the ionospheric scatter communications against the signals arriving by backscattering.

Control Systems Lab., U. of Illinois, Urbana.
THE TRANSIENT RESPONSE OF CASCADED BUTTERWORTH FILTERS, by Bruce L. Hicks and Rosemarie Stemmler. Rept. on Contract DA 36-039-sc-56695. Aug 57, 26p. 3 refs. Rept. no. R-97; AD-144 937.
Order from LC mi$2.70, ph$4.80 PB 138 558

The impulse and step responses for cascaded, three or five pole Butterworth filters have been calculated on Illiac with an accuracy of three or more decimals. In this paper the dependence of the calculated step response upon the number of cascaded filters λ_2 studied, both with no phase correction and with complete phase correction, with λ_2 in the range from 4 to 512.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
HANDBOOK OF METHODS OF COOLING AIR FORCE GROUND ELECTRONIC EQUIPMENT, by James P. Welsh and Thomas J. Walsh (Rome Air Development Center). Rept. on Contract NObsr-63043. June 59, 636p. 43 refs. RADC-TR-58-126; AD-148 907.
Order from OTS $8.00 PB 161 264

This Handbook was prepared to aid electronic engineers in the thermal design of reliable military electronic equipment. Enumerated herein are principles and techniques to be followed in the design of electronic parts, assemblies, and equipments, enabling

heat removal to be achieved to the greatest practical extent. It supplements previous CAL reports HF-710-D-16, NAVSHIPS 900, 187, AD-53 100; HF-845-D-8, NAVSHIPS 900, 192, AD-127 527; HF-845-D-9, NAVSHIPS 900, 185; HF-845-D-19, NAVSHIPS 900, 194; AD-202 440, and HF-1053-D-3, AD-141 400.

Cruft Lab., Harvard U., Cambridge, Mass.
CROSS RELAXATION IN SPIN SYSTEMS, by N. Bloembergen, S. Shapiro and others. Technical rept. on Contract Nonr-1866(28). 15 Oct 58, 54p. 38 refs. Technical rept. no. 285.
Order from LC mi$3.60, ph$9.30 PB 143 038

The energy transfer between adjacent resonances in nuclear and electron spin systems is analyzed in terms of the overlap of line-shape functions. The procedure is an enlargement on the original proposal of Kronig and Bouwkamp, and consists of taking partial account of off-diagonal elements in the spin-spin interaction, which are omitted in Van Vleck's truncated Hamiltonian.

Dalmo Victor Co., San Carlos, Calif.
OPTICAL AND ELECTROMAGNETIC TECHNIQUES FOR PREDICTION OF RADOME BORESIGHT ERRORS, by George M. Hahn. Rept. for 1 July 54-30 May 57 on Radome Techniques and Components, Contract AF 33(616)2524. Aug 59, 86p. 9 refs. WADC Technical note 59-257.
Order from OTS $2.25 PB 161 126

The rigorous electromagnetic solution to the radome problem will yield a method applicable to all radomes; however, the cumbersome computation requirements might make such an approach highly undesirable for many radomes whose characteristics are such as to permit the use of a much simpler optical technique. A thorough "state-of-the-art" survey indicates that considerable work has been completed elsewhere utilizing optical techniques. Reasonable results have been obtained whenever the radomes involved were governed by the following restrictions: 1. Antenna apertures greater than 10 wavelengths in diameter. 2. Clearance between antenna and radome housing of the order of wavelengths. 3. Radome wall curvature such as to permit the use of flat panel approximations. The prediction program was divided into two parts. The optical approach was to be simplified to such an extent that no large scale computing efforts would be required for boresight error predictions, and a new approach was to be devised utilizing electromagnetic methods for those radomes which do not have the three qualifications listed above. The optical approach promising the most rapid results is described in Section II of this report. A comparison of theoretical results with experimental data is included. The electromagnetic approach, which seems to be attractive at this time, is recorded in Section III of this report. A detailed account of directions for computer programming for one particular radome is included.

Diamond Ordnance Fuze Labs., Washington, D. C.
TRANSISTORIZED POWER SUPPLIES: A LITERATURE SURVEY, by Floyd Allen. 25 Aug 59, 24p. 17 refs. TR-725.
Order from OTS $0.75 PB 161 266

High voltages may be obtained from a low-voltage d-c supply when some form of converter is employed. A literature survey shows that transistorized converters, because of their high efficiency and lack of moving parts, are tending to displace rotary converters and vibrator-power units. Various transistor circuits of interest in ammunition electronics for converting dc-to-ac or dc-to-dc are reviewed here. The ringing choke converter offers a simple method of obtaining high voltage at power levels up to about two watts. For powers up to 200 watts the transformer-coupled, push-pull circuit is recommended. Of particular interest is the driven type converter for high-power, single- and three-phase applications.

Dikewood Corp., Albuquerque, N. Mex.
REDUNDANCY FOR IMPROVING ACCURACY IN COMMUNICATIONS, by B. L. Basore. Final rept. on Contract AF 19(604)4078. 30 June 59, 46p. 11 refs. AFCRC-TR-59-170, AD-225 956.
Order from LC mi$3.30, ph$7.80 PB 143 507

This report summarizes a study of the role of redundancy in communication. The investigation was carried out principally in terms of an n-dimension model of message space to determine an intuitively clear method of comparing the significance of redundancy in reducing error rates in a communication link with the contribution realized through the use of long messages and delay. The study clearly indicates that the cost of communications including the cost of terminal coding and decoding equipment is not necessarily optimized when the channel capacity is used at highest efficiency, but a trade of channel capacity (in the use of redundancy) for improved reliability, i e., accuracy, may often be justified.

Douglas Aircraft Co., Inc., Long Beach, Calif.
DEVELOPMENT OF A VHF FAN ANTENNA FOR THE C-133A AIRCRAFT, by J. A. Kobe, E. C. Alsenz and H. J. Katzman. Rept. on Contract AF 33(600)22452. 15 Jan 55, 341p. 2 refs. Engineering rept. no. LB-21742.
Order from LC mi$11.10, ph$53.10 PB 143 334

The antenna discussed in this report is for use in the 100-156 mc frequency range on the C-133A aircraft. It is a fan-shaped vertical stub located on the top of the vertical stabilizer and has been designed from existing data. Necessary compensations were added to achieve a 2:1 VSWR. Radiation coverage is adequate for the purpose of the associated equipment.

Dunham Lab., Yale U., New Haven, Conn.
MAGNETIC AMPLIFIER CIRCUITS. PART I. THE SERIES CIRCUIT WITH A NONLINEAR INDUCTOR, by Amram Rasiel. Rept. on Improved Amplifiers for Flight Control Applications, Contract AF 33(616)3391. May 59, 101p. 56 refs. WADC Technical rept. 57-43, Pt. 1; AD-226 798.
Order from OTS $2.50 PB 161 142

The purpose of the present work is to investigate the oscillations of a circuit with non-linear restoring force, in particular under the influence of a driving force, and to explain the mechanism by which subharmonics of the driving force are generated in the circuit response. The general equation describing the oscillations of the circuit is first obtained. The free oscillations of the circuit are then examined in detail for circuits with non-linear restoring force given by a polynomial. In particular, when this polynomial is an odd cubic parabola, relationships between the period of the oscillations and the initial conditions are obtained in a closed form depending on the circuit parameters. The forced oscillations of the circuit are then investigated by obtaining an approximate first integral in the phase-plane. It is found that there are in general two different stable first integrals. One is associated with the forced oscillations of the linear equation and goes to zero with the driving force. The other is associated with the free oscillations of the circuit and remains finite as the driving force goes to zero. The role of the second solution in the mechanism of subharmonic generation is then discussed and the conditions under which subharmonic may exist are investigated. Four appendices, containing calculations and discussions, are included.

Dunham Lab., Yale U., New Haven, Conn.
MAGNETIC AMPLIFIER CIRCUITS, PART II. THE FULL-WAVE BRIDGE AMPLIFIER WITH TWO-TERMINAL LOADS, by Richard Clark Barker. Rept. on Improved Amplifiers for Flight Control Applications, Contract AF 33(616)3391. May 59, 100p. 4 refs. WADC Technical rept. 57-43, Pt. 2.
Order from OTS $2.25 PB 161 086

This report provides an analysis of a "universal" full-wave-bridge magnetic amplifier and several circuits and connection configurations are examined for two-terminal loads. Many of the aspects of the amplifier have been examined and explained and the mathematical relationships of the various components have been derived. An attempt has been made to describe the physics of the amplifier in an easy to understand manner. (See also PB 161 142)

Eastman Kodak Co., Rochester, N. Y.
BASIC RESEARCH INVESTIGATION FOR AMMONIA VAPOR ACTIVATED BATTERIES, by J. M. Freund, V. M. Bryant, Jr. and J. B. Schliff. Quarterly progress rept. no. 6, 15 Dec 58-14 Mar 59, on Contract DA 36-039-sc-74902. [1959] 35p.
Order from LC mi$3.00, ph$6.30 PB 143 896

This report presents data on the specific conductivity of NH_4SCN solutions in NH_3. Information is given for very concentrated solutions, ranging from 20 to 40 mol percent NH_4SCN at temperatures ranging from saturation to +40°C. and higher. It is evident that the specific conductivity increases with rising temperature at all concentrations in this range; whereas it decreases with increasing concentration. Values range from 0.050 $ohm^{-1}cm^{-1}$ to 0.500 $ohm^{-1}cm^{-1}$. Less concentrated solutions were also studied at temperatures below -40°C. It was observed that at -56°C.. the specific conductivity increases with increasing concentration to a peak of 0.135 $ohm^{-1}cm^{-1}$ at 6.5 mol percent, and then decreases as the concentration is further increased. Some data on NaSCN, KSCN, and $Mg(SCN)_2$ solution conductivities are also presented. (See also PB 140 618)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
SECONDARY ELECTRON MULTIPLICATION IN MICROWAVE FIELD, by Frank Fu Fang. Scientific rept. no. 6 on Contract AF 19(604)2152. 15 May 59, 127p. 31 refs. AFCRC-TN-59-362; AD-217 035.
Order from LC mi$6.30, ph$19.80 PB 144 002

The electron dynamics of a periodic secondary electron multiplication process at microwave frequencies known as "multipactor" is analyzed theoretically and experimentally.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
COST CONSIDERATIONS IN THE EVALUATION OF ELECTRONIC COUNTERMEASURE SYSTEMS, by Guy Black. Rept. on Contract DA 36-039-sc-73170. 24 Apr 57, 48p. 31 refs. Technical memo. no. EDL-M109; AD-141 067.
Order from LC mi$3.30, ph$7.80 PB 138 566

The means of developing the cost information for significant and accurate parameters of models are discussed and the appropriate models are developed. The combined cost of system development, fabrication, and employment is considered. For analytical purposes, this cost is divided into investment and operating phases. The problems of cost analysis are examined and the methodology of cost estimation is discussed both generally and applied to particular phases. The theory of costs and the synthesis of over-all costs of complex operations from estimates for simple operations are explained in an appendix. Special attention is given maintenance cost analysis, which can be treated theoretically by models relating equipment design to reliability; the reliability analysis undertaken in electronics can be used in part in this analysis.

Electronics Research Lab., Stanford U., Calif.
MAXIMALLY-FLAT PHASE-DIFFERENCE NETWORK DESIGN, by George L. Matthaei. Technical rept. no. 2 on Contract AF 28(099)83. 31 Oct 50, 42p. 10 refs. ATI-96073.
Order from LC mi$3.30, ph$7.80 PB 144 064

The theory of networks which realize a constant difference in the phases of two outputs, over a wide band of frequencies, in the equal-ripple or Chebyshev manner is here extended to the limiting case of zero error and zero bandwidth. This is the maximally-flat or Taylor type of approximation. The electrostatic potential analogy is used, with an appropriate conformal transformation, to develop the mathematical theory, and a design procedure is developed. For application to single-sideband systems, a comparison is made of the performances of these and of the equal-ripple type. The maximally-flat type offers no advantage, in fact is inferior, in this application. There may,

however, be other applications in which the inherently smooth approximation of this type will be useful.

Electronics Research Lab., U. of California, Berkeley.
QUARTERLY PROGRESS REPORT, by S. Silver. Rept. for 1 July-30 Sep 58 on Contracts N7onr-29529, Nonr-222(53, 54, 57). 31 Oct 58, 22p. Series no. 60, Issue no. 22.
Order from LC mi$2.70, ph$4.80 PB 143 555

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Diffraction of plane waves by a circular aperture in a thin infinite plane conductor
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Electronics Research Lab., Stanford U., Calif.
A STUDY OF THE APPROXIMATION PROBLEM FOR LINEAR-PHASE CONSTANT-PHASE-DIFFERENCE NETWORKS, by David D. Cherry. Technical rept. no. 4 on Contract AF 28(099)83. 29 June 51, 165p. 28 refs. ATI-139 916.
Order from LC mi$7.80, ph$25.80 PB 144 063

The need has arisen in single-sideband systems for networks that will give a constant phase difference of 90° over a frequency band of some width. Although this problem has been solved to some extent, the transient response and so-called delay characteristic for such networks are not all that could be desired. To improve these, attention is focussed herein on the problem of linear-phase, constant-phase-difference networks. The problem considers all-pass networks only. There are three different phase characteristics that are formulated and investigated. The first type is chosen as the linear transmission phase characteristic; the second type is chosen as one offset from the first type by ninety degrees. Then the difference between these two is to be the constant phase difference for which the solution is sought. The approximation is limited to a definite portion of the real frequency spectrum, usually normalized symmetrically about the origin from zero to one radian per second. As one by-product of this investigation, attempts are made to formulate a design procedure for an arbitrary-phase characteristic.

Electronics Research Labs., Columbia U., New York.
RESEARCH IN DESIGN TECHNIQUES FOR CONTROL SYSTEMS BY ELECTRONIC SIMULATION OF THE COMPLEX PLANE, by Stanley Fenster and John Wuorinen. Interim final rept. IF/110 for 1 Oct 53-31 May 56 on Contract AF 18(600)962. 30 June 56, 28p. 16 refs. CU-13-56-AF-962-EE; AFOSR-TR-56-[64]; AD-154 226.
Order from LC mi$2.70, ph$4.80 PB 144 066

This report covers research done on the complex Plane Scanner (CPS) of Contract AF 18(600)-962 with the Air Research and Development Command during the period 1 October 1953 through 31 May 1956. Research was devoted to study of methods of applying the scanning of the complex plane to the solution of various problems occurring in linear systems, to study of implementation of such scanning in electronic form, and to development of displays useful in engineering design problems. The theory of an electronic analog method of scanning the complex plane is outlined and applications of this theory are indicated. The Complex Plane Scanner (CPS), an analog computer, the operation of which is based on this method, is described. System block diagrams and waveforms are included.

General Electric Co. [Schenectady, N. Y.]
ULTRA HIGH TEMPERATURE (500°C) POWER TRANSFORMERS AND INDUCTORS, by Harold B. Harms and James C. Fraser. Rept. for 1 Mar 58-28 Feb 59 on Improved Electronic Components, Contract AF 33(616)5579. July 59, 576p. 15 refs. WADC Technical rept. 59-348.
Order from OTS $7.00 PB 161 046

Contract objectives called for the development of electronic power transformers capable of operation in a 500°C ambient temperature and in intense nuclear radiation. New projects were breakdown potential of air up to 500°C temperature and in a radiation environment, an impregnation material development, and a design optimization study. The breakdown potential of air was found to be significantly affected by nuclear radiation but only slightly by high temperature. A versatile material, aluminum phosphate solution, was found to be a useful coil impregnant by imparting strength to the insulations. Two constructions remain in the program, one a miniature hermetic whose encasement conforms to the contours of the core and coil, and a standard hermetic. Although it offers a substantial size and weight reduction, the former is more difficult to construct; both are capable of withstanding the mechanical, temperature and radiation requirements of the contract. A very significant advance in the high temperature magnet wire field was uncovered in a ceramic insulated nickel-clad copper wire. It offers a thin film insulation in very small wire diameters. The chief effect of radiation on the transformers tested was to create an extra internal source of heat and, thereby, to increase their temperature rise. An optimization procedure was developed and partially checked on a digital computer. The assembly of a design practice summarizes the favorable aspects of two contract periods.

Hazeltine Electronics Corp., Little Neck, N. Y.
FEASIBILITY OF TRANSISTORIZING BEACON, RADIO AN/DPN-31( ), by Robert Olsen, Ronald A. Orlando, and others. Final technical rept., phase 1, 15 June 56-14 Feb 57, on Contract DA 36-039-sc-72417. [1957] 61p. 18 refs. Rept. no. 9841; AD-146 686.
Order from LC mi$3.90, ph$10.80 PB 138 557

A study was carried out to determine whether it is feasible to transistorize Radio Beacon AN/DPN-31 (XE-1). It was concluded that transistorizing all stages of AN/DPN-31(XE-1) except the transmitter-oscillator, modulator, and modulator driver is now feasible. Breadboard models of the receiver, decoder, and command channels and the blocking-oscillator chain were constructed and successfully tested. It was not possible to reduce the modulation power required by grid pulsing the S-band cavity. Until power transistors with higher alpha-cutoff frequencies become available, a transistorized modulator and a transistorized modulator driver will not be feasible, except that restrictions on the former would be lessened considerably if technical requirements for the system could be altered to increase the delay between interrogation and reply to 12 μsec or so. The partially transistorized beacon now considered feasible would be no smaller and might be slightly heavier than AN/DPN-31(XE-1). However, if a transistorized modulator were feasible, large savings in size and weight as well as power would be possible.

Hughes Aircraft Co., Culver City, Calif.
BEAM POINTING ERRORS OF LONG LINE SOURCES, by M. Leichter. Rept. on Contract AF 30(602)1718. Apr 59, 38p. 11 refs. Technical memo. no. 588.
Order from LC mi$3.00, ph$6.30 PB 143 606

The relation between the statistics of the antenna beam pointing direction and the phase and amplitude errors at the source has been obtained to first order in the mean square errors, under certain restrictions, for long line sources. It is shown that when the desired phase at the source is a constant the results are, to first order, independent of the amplitude errors. When the desired amplitude is also constant there is a simple formula for computing the allowable rms phase error at the source when the pointing direction is required to lie in a given angular range with a given probability. When the amplitude distribution corresponds to the Taylor modified (sin x)/x pattern, the allowed rms phase error is obtained from the constant amplitude case by a multiplicative factor which depends only on the one parameter characterizing the Taylor distribution. This function is plotted for the range corresponding to sidelobe ratios of 13.2 to 40 db. At 40 db the allowed rms phase errors are about three fourths of the allowed rms phase errors at 13.2 db (constant amplitude) for the same uncertainty in the pointing direction. The results are applied to a hypothetical example and to an actual "Mills Cross" for illustrative purposes.

Institute for the Study of Metals, U. of Chicago, Ill.
IMPROVEMENTS ON A SIMPLE TEMPERATURE CONTROLLER, by C. T. Tomizuka and D. Zimmerman. Rept. on Contract AF 18(600)1489. 14 Nov 58, 6p. 2 refs. AFOSR-TN-58-942; AD-205 084.
Order from LC mi$1.80, ph$1.80 PB 138 420

A circuit was developed to be an improvement over a single temperature controller previously developed by Wilson and presently enjoying use in many laboratories. It uses a transistor preamplifier followed by a small thyratron activating a relay. The buzz frequency can attain 10 cycles/sec., a frequency which would destroy an ordinary relay.

International Telemetering Corp., Los Angeles, Calif.
THE TRACK-FOLLOWING SERVO SYSTEM. Technical rept. no. 11 on Computer Set, General Information Data AN/GSQ-16(XW-1) (Photoscopic Information Storage Unit) Contract AF 30(602)1566. 20 Mar 57, 32p. RADC TN-57-162; AD-114 437.
Order from LC mi$3.00, ph$6.30 PB 138 682

Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus.
THE AMPLITUDE ANALYZER, by Arthur C. Erdman, A. B. Fontaine, and David G. McConnell. Rept. on Contract AF 41(657)70. July 59, 21p. 2 refs. WADC Technical rept. 59-45; AD-227 481.
Order from OTS $0.75 PB 161 110

This report described a device developed for extracting information for a trend analysis of low-frequency (0.66 cpm to 4.98 cpm) signals with respect to amplitude of occurrence during a time period. The system here described uses 30 mechanical counters to accumulate a score equivalent to the time that a signal dwells within a predetermined voltage band. A comprehensive discussion as to the electronic principles and techniques is provided.

Machlett Labs., Inc., Springdale, Conn.
EVALUATION OF UHF PLANAR TRIODE TUBE TYPE 2C39A IN THE POSITIVE GRID REGION, by W. Brunhart. Final technical rept. for 1 Feb-31 Oct 58 on Contract DA 36-039-sc-74816. [1958] 44p.
Order from LC mi$3.30, ph$7.80 PB 142 994

Tests were performed on 2C39A and 2C39WA type tubes in accordance with the tentative technical requirement. Based on the accumulated data, test limits are proposed for inclusion in procurement specifications. However, it is recommended for the sake of uniformity to use slightly different test conditions and corresponding limits and to eliminate the positive grid current division test, since it is felt that this test does not result in new information about the tube. It was found that the presently used JAN specifications do in no way cover the tube performance with respect to the 4.5 ms pulse test.

Magnetic Research Corp., El Segundo, Calif.
NEW METHODS OF MAGNETIC PULSE GENERATION, by B. M. Wolfframm. Rept. on Improved Electronic Components, Contract AF 33(616)2970. Dec 57, 55p. 10 refs. WADC Technical rept. 57-66.
Order from OTS $1.50 PB 131 651

The efficiency of magnetic pulse generators is analyzed by locating their core losses. Because of saturation of magnetic components the major portion of losses can be found in the cores. The wattmeter and calorimetric methods are used to determine the losses

of single components as well as those of the whole system. In addition, an evaluation of the voltage pulse into resistive load is made. The results obtained in different ways vary only a few per cent and indicate almost fifty per cent efficiency for a three-stage pulse generator. Tests are reported on a pulse generator that is capable of changing the repetition rate by a ratio of 1:2, and also on a pulse generator with continuous changing repetition rate. Methods of pulse width control mentioned in earlier reports have been tested on the magnetron power level and indicate a successful solution for a variable pulse width.

Maryland U., College Park.
AN ASYMPTOTIC CAUSALITY REQUIREMENT FOR SYSTEMS WITH CONSTRAINED INPUTS, by J. Sucher. Rept. on Contract AF 49(638)24. July 59, 14p. 6 refs. Physics Dept. Technical rept. no. 141, AFOSR-TN-59-773, AD-220 577.
Order from LC mi$2.40, ph$3.30 PB 143 156

The usual formulation of causality for simple linear systems: "no output before input", may fail to imply that the system kernel, $K(\tau)$, is a causal function of the time delay τ, because the class of physically admissable input functions may not contain a complete set of causal signals. An attempt is made to formulate a causality requirement, asymptotic in nature, which overcomes this difficulty. It is found, rather generally, that systems which satisfy this requirement cannot have a finitely acausal kernel. If it could be shown that the kernel cannot be infinitely acausal, the validity of the usual dispersion relations for such systems would be ensured.

[Material Lab.] New York Naval Shipyard, Brooklyn.
TITANIUM CATHODE COUNTER TUBES, UNIVERSITY OF MARYLAND, EVALUATION OF, by A. B. Jones, Jr. Final rept. 10 Apr 57, 7p. Lab. Project 5115-B-19.62; AD-140 792.
Order from LC mi$1.80, ph$1.80 PB 138 567

The tubes were halogen-quenched, glass-enclosed cylindrical counter tubes with cylindrical titanium cathodes 3 in. long and 1/2 in. in diameter surrounding a 5-mil tungsten anode wire. The filling was a mixture of chlorine and neon under pressures of 0.5 and 400 mm Hg, respectively. The operating ability of 3 tubes over 8899 hr of active life and of 2 tubes over 14,050 hr of active life indicated a degree of stability not shown by most tube types presently in the field. Likewise, a high degree of stability in plateau characteristics was shown by the subject tubes over 617 days of shelf life. Significant changes occurred in tube response and plateau characteristics over the temperature range of -55° to 75°C. The count rate and current increased with depressed temperature and decreased with elevated temperature. It is recommended that the titanium cathode counter tube be improved mechanically and be further investigated for possible use in the Navy Radiac equipments.

Microwave Electronics Lab., Rutgers State U., New Brunswick, N. J.
POWER CONVERSION WITH NONLINEAR REACTANCES, by Edward Della Torre and Murray D. Sirkis. Rept. on Contract AF 49(638)554. June 59, 14p. 10 refs. Research rept. 59-1; AFOSR-TN-59-596; AD-217 181.
Order from LC mi$2.40, ph$3.30 PB 143 958

The Manley-Rowe relationships for a nonlinear reactance are derived proceeding from the voltage-charge characteristic for a capacitance. The method used follows the work of Van der Ziel. The problem is generalized to an arbitrary number of generators. A criterion on the degree of nonlinearity required for power conversion to power at a particular frequency is also derived. A condition on the oscillator frequencies is found, but this condition proves to be less strict in any practical case than the Manley-Rowe requirement of incommensurability. Output filter considerations are also discussed.

Microwave Engineering Labs., Inc., Palo Alto, Calif.
INVESTIGATION OF MICROWAVE NON-LINEAR EFFECTS UTILIZING FERROMAGNETIC MATERIALS, by Wesley P. Ayres and Perry H. Vartanian. Quarterly progress rept. for 4 May- 2 Aug 58 on Contract DA 36-039-sc-73278. [1958] 27p. 3 refs.
Order from LC mi$2.70, ph$4.80 PB 138 832

The harmonic generation measurement system has been improved by the addition of a new more sensitive crystal detector, a calibrated variable attenuator, a directional coupler and a phase shifter. A ferromagnetic amplifier has been operated in both the degenerate and non-degenerate conditions of electromagnetic mode operation.

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HIGH POWER MAGNETIC FIELD CONTROLLED MICROWAVE GAS DISCHARGE SWITCH, by S. J. Tetenbaum and R. M. Hill. Rept. on Contracts DA 36-039-sc-(71053, 73188). 22 July 57, 69p. 19 refs. Technical rept. MPL-8; AD-142 943.
Order from LC mi$3.90, ph$10.80 PB 138 554

A broadband magnetic field controlled, microwave gas discharge switch is described which is capable of rapidly switching high peak and average power at S band. The switch consists of two gas-filled tubes located at the junction of a rectangular waveguide Y-configuration One or the other of the switch tubes is fired by the incident microwave power when a magnetic field is applied to it. The high electron density of the discharge acts like a short circuit in one input arm of the Y effectively connecting the other input arm to the output.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
BROADBAND, BEAD-SUPPORTED COAXIAL LINES AND FITTINGS, by Paul G. Mariotti. Final rept. on Contract DA 36-039-sc-64456. 16 Mar 56, 74p. Rept. no. R-474-56; PIB-404.
Order from LC mi$4.50, ph$12.30 PB 129 483

Type "N" Connectors were designed for use with 1/2" O. D. and 7/8" O. D. semiflexible Styroflex line of both waterproof and pressurized types. In addition, a 7/8" RETMA rigid line flange was modified to accept a 7/8" O. D. semiflexible Styroflex line. A rotary joint in 7/8" RETMA line has been designed and developed. This design was then scaled and constructed for the 1-5/8" O. D. RETMA line. Values of $\lambda/\lambda g$ as a function of frequency were calculated for the 1/2" Styroflex line for higher mode operation. Values of $\lambda/\lambda g$ as a function of frequency were also calculated for the 7/8" line up to the first critical frequency. The changes of $\lambda/\lambda g$ are indicative of characteristic impedance change. The values of $\lambda/\lambda g$ were checked experimentally for the 7/8" line by means of a cavity technique. A comparison of performance parameters for various Styroflex type line is presented.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
COUPLED LEAKY WAVEGUIDES. II. TWO PARALLEL SLITS IN A CYLINDER, by S. Nishida. Rept. on Contract AF 19(604)2031. 10 June 59, 22p. 4 refs. Research rept. R-746-59; PIB-674; AFCRC-TN-59-392.
Order from LC mi$2.70, ph$4.80 PB 143 400

Theoretical expressions are derived for the effects of mutual coupling between two parallel leaky wave antennas which consist of slitted rectangular waveguides located in a cylinder. The expressions derived are presented in terms of the infinite plane result with additional terms due to the curvature of the cylinder. The graphical presentation of the numerical attenuation constants for the cylindrical case are compared with those for the infinite plane. (See also PB 135 401)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
FREQUENCY TRANSFORMATION AND TRANSMISSION LINE FILTERS, by Yosef Shalev and Eugene N. Torgow. Rept. on Contract AF 30(602)1650. 29 Apr 59, 86p. 11 refs. Research rept. R-706-59; PIB-634; RADC-TN-59-181; AD-216 435.
Order from LC mi$4.80, ph$13.80 PB 143 769

A technique for the design of high-pass and band-pass transmission line filters, by transformation from low-pass prototype transmission line filter was investigated. Dealing with networks comprised of commensu rate sections of line, a change of variable $\lambda = j \tan \theta$ was introduced. The new variable λ may be regarded as a frequency variable, and it has been shown that theorems and synthesis procedures for lumped element networks, can be adopted and applied directly to the distributed case. A general proof as to the validity of the transformation technique for filter design in the lumped element case is worked out and the physical realizability of the transformed functions is demonstrated. In an analogous manner, the applicability of the transformation technique to distributed networks in the λ plane was examined.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
TUNABLE MICROWAVE FILTERS, by Danlyo Jacenko and Eugene N. Torgow. Rept. on Contract AF 30(602)1650. 6 May 59, 67p. 8 refs. Research rept. R-740-59; PIB-668; RADC-TN-59-180; AD-216 436.
Order from LC mi$3.90, ph$10.80 PB 143 768

Tunable bandpass microwave filters with independently adjustable upper and lower cutoff frequencies have been developed. These filters use the hybrid junction cutoff waveguide structure which is modified, in the waveguide case, by the introduction of variable height ridges in the cutoff waveguide sections. The center frequency of the pass band can be varied over a maximum band of 20% and the bandwidth can be varied from 1.5% to 20% with low pass band losses. The maximum insertion loss at midband is 1.0 db. for the narrowest bandwidth. It has been shown that this loss can be significantly reduced by minimizing the reflections from the tapered line inputs to the cutoff waveguide sections.

National Bureau of Standards, Washington, D. C.
RESISTANCE DIODE BRIDGE CIRCUIT FOR TEMPERATURE CONTROL, by Lawrence H. Bennett and Van M. Johnson. Oct 59, 4p. 3 refs. Technical note 34.
Order from OTS $0.50 PB 151 393

The conventional ac bridge gives irregular performance including loss of temperature control when the temperature error exceeds a certain critical value. The present note describes a simple method of achieving stable temperature control over a large range of temperatures.

Naval Air Development Center, Johnsville, Pa.
A TRANSISTOR ZERO-CROSSING DETECTOR, by John S. Denelsbeck. 16 Oct 58, 13p. 1 ref. Rept. no. NADC-ED-5826; AD-208 277.
Order from LC mi$2.40, ph$3.30 PB 144 108

A transistor detector is described which generates a pulse whenever the input waveform passes through zero. This device utilizes a combination of two grounded-emitter amplifiers which are fed by input signals of opposite phase relationship. Although specifically designed for use in a synchro shaft position encoder, this zero-crossing detector also has application as a composite pulse generator and as a frequency doubler.

Naval Ordnance Lab., White Oak, Md.
A FERRORESONANT REGULATOR WITH CONTROLLABLE OUTPUT, by George Schohan. 2 Oct 57, 29p. 5 refs. NAVORD rept. 5741.
Order from LC mi$2.70, ph$4.80 PB 143 308

A solution to the problem of obtaining essentially instantaneous correction for A. C. line voltage changes is shown. The combination of a ferroresonant regulator having controllable output voltage with degenerative feedback to produce a regulator having constant output voltage for changes in line

voltage, frequency and load conditions is discussed. Design procedures and actual construction details of a 1000 VA ferroresonant circuit are given.

Naval Ordnance Lab., White Oak, Md.
THEORY OF NOISE IN A MULTIDIMENSIONAL SEMICONDUCTOR WITH A P-N JUNCTION, by Max Solow. Doctoral thesis. 26 June 57, 102p. 18 refs. NAVORD rept. 5762; AD-205 428.
Order from LC mi$5.70, ph$16.80 PB 144 046

In the p-n junction the noise is the result of fluctuations in the minority carrier density, holes in the n-type material and electrons in the p-type material. The noise problem is solved by using Langevin equations and interpreting the distributed sources as random forces.

Naval Research Lab., Washington, D. C.
AN AUTOMATIC RADAR RANGE MOON TRACKING SYSTEM, by John E. Abel and Charles F. White. Final rept. 11 Aug 58, 27p. Rept. 5170.
Order from LC mi$2.70, ph$4.80 PB 133 235

The design and construction of a high-performance automatic range tracking system for radar echoes from the moon is reported. The servo-system transfer function employed is based upon range variations of the signal due to the maximum earth-moon distance variation with time and upon "velocity memory" requirements arising from the nature of the input signal. The impracticality of conventional measurement methods in repeated experimental verification during system development of transfer functions extending from 100 rad/sec to below 0.0001 rad/sec led to employment of analog techniques in a feedback system testing method by which open-loop transfer functions are determined from closed-loop transient testing.

Naval Research Lab., Washington, D. C.
ELECTROMAGNETIC PROBES FOR NEAR-ZONE MEASUREMENTS, by D. C. Rohlfs, W. W. Balwanz, and F. E. Boyd. Interim rept. 5 Oct 59, 42p. 9 refs. NRL rept. 5378.
Order from LC mi$3.30, ph$7.80 PB 142 451

A set of detailed drawings of horns, lenses, and heat-protection covers and photographs of antenna structures illustrate the instrumentation utilized at NRL to provide the focused electromagnetic beams used in flame-conductivity studies. These drawings have been compiled for the convenience of workers in the field of rocket-exhaust studies.

Naval Research Lab., Washington, D. C.
INVESTIGATION OF OSCILLATOR CIRCUITS FOR USE WITH CR-9/U OVER-MODE CRYSTAL UNITS, by Bertram C. Hill, Jr. and Sylvaine L. Kenyon. 1 Nov 47, declassified 15 Dec 53. 35p. NRL rept. no. R-3158.
Order from LC mi$3.00, ph$6.30 PB 129 172

The overall performance of some early production CR-9/U over Mode Crystal Units was evaluated in the activity in terms of series resonant resistance, frequency stability and the type of holder used to mount the crystal plate. Crystal activity was, on the average, satisfactory. Frequency drift was generally excessive and further tests showed that both crystal frequency stability and crystal activity were functions of the voltage applied across the unit - the lower the voltage drive across the unit, the greater the crystal frequency stability, with activity varying with drive.

Naval Research Lab., Washington, D. C.
A THREE-LEVEL CHROMIUM ION MASER, by M. A. Garstens and W. W. McAllister. Progress rept. 13 Nov 59, 8p. 4 refs. NRL rept. 5400.
Order from OTS $0.50 PB 151 996

A brief discussion of three-level solid state maser theory is presented, as well as the experimental results for a chromium ion ruby maser operated both at temperatures of liquid helium and liquid nitrogen.

Naval Research Lab., Washington, D. C.
THE ZERO CROSSING PROBLEM, by D. F. Grady. Interim rept. 10 Nov 59, 22p. 4 refs. NRL rept. 5397
Order from LC mi$2.70, ph$4.80 PB 142 595

One of the basic problems encountered in the analysis of signals is that of determining the effect of noise, which is inevitably present along with the signal, on the frequency of the signal. One method of determining frequency is to measure the number of crossings of the zero axis by the signal. A pure sine wave of frequency f_0 would have $2f_0$ zero crossings per second. A sine wave has a fixed frequency, whereas random noise is composed of a mixture of frequencies; when noise is present with a sine wave, the frequency of the composite signal will be in doubt due to the random variations of the noise. One approach to predicting the frequency of a composite signal of a sine wave plus noise is to determine by measurement the number of zero crossings of the composite signal. This method of analysis includes the case of predicting the frequency of random noise as an introduction to the case of random noise plus a sine wave. For a sine wave plus random noise passed through a low-pass filter with a cutoff frequency of five times the frequency of the sine wave and an input signal-to-noise ratio of one, it was found that the frequency of the composite signal determined by measuring the number of zero crossings was over twice the frequency of the input sine wave. A set of curves was plotted for various low-pass and bandpass filters.

Navy Electronics Lab., San Diego, Calif.
TECHNIQUES FOR RECORDING SURFACE BIOELECTRIC DIRECT CURRENTS, by A. Ford and J. L. Leonard. 6 May 58, 23p. 16 refs. Research rept. no. 839.
Order from LC mi$2.70, ph$4.80 PB 143 733

Despite its potential value in human engineering, bioelectric DC recording has been neglected in comparison with AC recording. The neglect is a result of the experimental difficulties encountered in DC recording, particularly in avoiding electrical

drift effects. This report describes successful DC recording techniques, largely developed at NEL, with special emphasis on the fabrication and application of silver-silver chloride electrodes.

New York U. Coll. of Engineering, N. Y.
EXTENSION OF NULL-RECEPTION ANALYSIS TO BINARY COMMUNICATION SYSTEMS EMPLOYING ENVELOPE DETECTION, INCLUDING FSK, by J. J. Metzner and K. C. Morgan. Scientific rept. no. 8 on Contract AF 19(604)1964. 1 July 59, 120p. 24 refs. AFCRC-TN-59-562.
Order from LC mi$6.00, ph$18.30 PB 143 662

The effects of applying the null-zone decision mechanism to two types of envelope-detection systems have been investigated, and comparisons have been made with previous results for synchronous-detection systems, primarily within the framework of discarding and cumulative decision-feedback configurations. (See also PB 142 384)

Office of Scientific Research and Development. Div. 6.
A MANUAL OF CALIBRATION MEASUREMENTS OF SONAR EQUIPMENT. Summary technical rept. vol. 11, on Contract OEMsr-1130. 1946, declassified 17 July 58. 360p. 229 refs. AD-200 789
Order from LC mi$11.10, ep$57.60 PB 144 163

Contents:
Standards used by the underwater sound reference laboratories
U. S. Navy sonar equipments
Domes
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Naval laboratories' designs
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Ohio State U. Research Foundation, Columbus.
STUDY OF RADIOTELEPHONE VOICE PROCEDURES AND RELATED RESEARCH, by Henry M. Moser. Final rept. for 1 Dec 55-30 Sep 58 on Contract AF 19(604)1577. 30 Sep 58, 37p. 42 refs. AFCRC-TR-58-52; AD-160 711.
Order from LC mi$3.00, ph$6.30 PB 138 593

Experimental work along applied, theoretical, and exploratory lines with special attention given to recommended research along lines suggested by the International Civil Aviation Organization on an International Language for Aviation as well as additional work with hand signals in aviation.

Palmer Physical Lab., Princeton U., N. J.
SIGNAL TO BACKGROUND RATIO OF GATED AND UNGATED IMAGE TUBES, by Geo. T. Reynolds and D. Scarl. Technical rept. no. 20 on Contract Nonr-1858(06). 12 Nov 58, 16p.
Order from LC mi$2.40, ph$3.30 PB 143 429

Pittsburgh Consolidation Coal Co., Library, Pa.
CONVERSION OF CARBONACEOUS FUELS TO ELECTRICAL ENERGY, by Everett Gorin and Howard L. Recht. Final rept. for 15 Aug 57-14 Aug 58 on Contract DA 36-039-sc-74941. [1958] 76p.
Order from LC mi$3.90, ph$10.80 PB 138 803

This work was directed toward the development of a high temperature fuel cell whose electrochemical output is derived from the free energy change in the combustion of gaseous fuels with air. The ultimate aim is the development of a cell which may be used in an integrated fuel cell - gasification system. It summarizes the results of the present one-year contract. Procedures have been worked out for the preparation of double-porosity lithiated nickel oxide air electrodes, and ultra-strong magnesia electrolyte matrices. The experimental work has been carried to the point where operations can be conducted with pressurized double porosity electrodes. Stable short term outputs of over 4×10^{-2} watts/cm^2 at approximately 0.5 volts have been obtained with both silver gauze and lithiated nickel oxide electrodes.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL SOURCES. VOLUME II. BATTERIES, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 99p. E-2FR049-332, AFOSR-TN-59-430, AD-214 780.
Order from OTS $2.25 PB 161 262

The following section comprises a summary of performance characteristics, structure, power weight ratios, and power volume ratios, whenever available, of chemical batteries. Performance data include such items as watt hours per pound, watt hours per cubic inch, behavior at low temperatures, unactivated shelf life, activated shelf life, rechargeability, reliability, open circuit voltage, average operating voltage, and adaptability for particular service. Fuel cells, essentially of the same class of converters of chemical energy into electrical energy will be discussed. So-called nuclear batteries are presented last.

Radiation, Inc., Melbourne, Fla.
TELEMETRIC DATA TRANSMITTING SET AN/AKT-14 AND TELEMETRIC DATA RECEIVING SET AN/UKR-7(XA-2). Final engineering rept. on Contract AF 33(600)27465. 29 Dec 58, 207p. 14 refs.
Order from LC mi$9.30, ph$31.80 PB 143 093

Radio Corp. of America, Camden, N. J.
TRANSISTORIZED INTERPHONE MICROPHONE AMPLIFIER, by Willard F. Meeker and R. Michael Carrell. Final rept. on Contract DA 36-039-sc-64453. [1954] 195p. 14 refs. AD-151 762.
Order from LC mi$8.70, ph$30.30 PB 138 552

Articulation tests were conducted to determine how to make the best use of speech peak clipping, preemphasis, deemphasis, and AGC in the microphone amplifier of an interphone system for Army aircraft in which the noise can be as high as 120 db. The system considered uses

M-33/AIC microphones, H-70/AIC headsets, and listening amplifiers of the AN/AIC-12(XC-1) intercommunication set. Results indicated that no pre-emphasis or deemphasis should be used, 6 to 12 db of peak clipping should be provided (under control of the listener), and AGC should be provided in the microphone amplifier. Word articulation performance with such a system was 82% in the presence of 120-db noise at talker and listener stations, 95% with 120-db talker noise and 50-db listener noise, 93% with less than 80-db talker noise and 120 db of listener noise, and 98% in the presence of about 50 db of talker and listener noise.

Raytheon Co., Newton, Mass.
INVESTIGATION OF THE CORRELATION OF STANDARD DIODE EMISSION STUDY CONTRACT FINDINGS WITH PRODUCTION TYPE TUBES USING STANDARD PRODUCTION EQUIPMENT, by F. Hill, C. Bardsley and others. Scientific rept. no. 2 for 16 Mar-15 June 59 on Contract AF 19(604)4095. 26 June 59, 52p. AFCRC-TN-59-382.
Order from LC mi$3.60, ph$9.30 PB 143 399

An evaluation and explanation of a rapid method for the determination of dynamic cathode activity is described. The results of a laboratory study of the effect of high and low pilot voltages on the decomposition rate of the cathode coating are listed. The lower the pilot voltage, the faster the rate of decomposition. Also, a method for the determination of the proper coil orientation and the results of its application is included.

[Remington Rand Univac Div., Sperry Rand Corp.] St. Paul, Minn.
PREPARATION AND CHARACTERISTICS OF MAGNETIC RECORDING SURFACES, by Edward D. Korhone, Lawrence W. Reid, and Walter L. Anderson. Rept. on Contract NObsr-42001. 7 Jan 49, 23p.
Order from LC mi$2.70, ph$4.80 PB 144 148

The operation of magnetic recording drums at high peripheral speeds has indicated the need for coatings with greater adhering properties than have been obtainable with recording tape and cements. In other tasks, the magnetic material has been deposited directly on the drum surface by brushing, dipping, and other similar means. The coatings thus obtained were non-homogeneous, fragile, and magnetically noisy. Further trials brought about the use of various spray methods, probably the first of which employed a crude atomizer, and next, ordinary paint spraying equipment. While these yielded promising results, it was not until an artist's airbrush was used that magnetically satisfactory coatings were achieved. However, the adherance to well-polished metal surfaces was still inadequate. This problem was overcome by the addition of a zinc-chromate primer coat to the drum before application of the magnetic material. This report is limited to practical considerations involved in the preparation of magnetic recording surfaces in the subject Task; the purpose is to describe the application of magnetic surfaces, and to compare characteristics of several types of surfaces.

Research Lab. of Electronics, Mass. Inst. of Tech., Cambridge.
QUARTERLY PROGRESS REPORT NO. 49 [DECEMBER 1, 1957]-FEBRUARY 28, 1958, by J. B. Wiesner, G. G. Harvey, and H. J. Zimmerman. Rept. on Contract DA 36-039-sc-64637. 15 Apr 58, 151p. 110 refs.
Order from LC mi$7.50, ph$24.30 PB 143 556

Contents:
I. Physical electronics
II. Microwave gaseous discharges
III. Solid state physics
IV. Microwave spectroscopy
V. Nuclear magnetic resonance and hyperfine structure
VI. Microwave electronics
VII. Atomic beams
VIII. Frequency modulation
IX. Statistical communication theory
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XII. Speech communication
XIII. Mechanical translation
XIV. Communications biophysics
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XVII. Shop notes

Rome Air Development Center, Griffiss AFB, N. Y.
ACCURACY IN THE ESTIMATION OF DEVIATIONS FROM THE GLIDEPATH AS A FUNCTION OF DISPLAY CONFIGURATION, by Edward F. LaForge and Edmund J. Kennedy. June 59, 11p. RADC-TN-59-140; AD-214 493.
Order from LC mi$2.40, ph$3.30 PB 144 081

This report describes the results of a comparative evaluation of two precision approach displays. The currently used azimuth-elevation CRT display was found to be less accurate in estimating quantified deviations from the glidepath than a display with visual references enabling rapid perception of deviations in azimuth and elevation. The detection of changes in these two dimensions is a critical requirement in monitoring guidance by both automatic and manual precision approach and landing systems.

Rome Air Development Center, Griffiss AFB, N. Y.
DESIGN AND DEVELOPMENT OF A HIGH-FREQUENCY RECEIVING-ANTENNA MULTICOUPLER, by Donald W. Sykes. Rept. on Contract AF 30(602)1492. Oct 59, 40p. RADC-TR-59-117.
Order from LC mi$3.00, ph$6.30 PB 143 954

This report lists the technical characteristics of the CU-483(XW-1)/GR antenna multicoupler developed by CGS Laboratories, Stamford, Connecticut, for Rome Air Development Center under Contract AF 30(602)1492. This equipment was developed to satisfy the current antenna coupler requirements of AACS and other Air Force organizations. The antenna multicoupler possesses exceptional performance characteristics and provides for the simultaneous operation of ten high-frequency receivers from one antenna.

Rome Air Development Center, Griffiss AFB, N. Y.
INTELLIGIBILITY TESTS ON THE R-361 (GRR-7) RECEIVER IN THE PRESENCE OF RF PULSE INTERFERENCE, by Joseph G. Molnar. June 59, 10p. 1 ref. RADC-TN-59-198; AD-216 700.
Order from LC mi$1.80, ph$1.80 PB 142 944

The results of the effects of RF pulse interference on a UHF voice receiver are discussed. Percentage word articulation is presented for desired signal levels of 3 - 100 microvolts in the presence of peak pulse interference 20 - 60 db greater. Test results on the R-361 receiver indicate that RF peak pulse interference 40 db greater than the desired signal level will enable a listener to obtain at least 50 percent word articulation and at least 83 percent sentence intelligibility.

Rome Air Development Center, Griffiss AFB, N.Y.
INTELLIGIBILITY TESTING OF VOICE COMMUNICATION SYSTEMS, by George E. Renaud. May 59, 10p. 4 refs. RADC-TN-59-156; AD-215 023.
Order from LC mi$1.80, ph$1.80 PB 143 750

This report describes methods of testing voice communication. Particular emphasis is placed on the use of PB-50 lists, developed by Harvard University, in testing actual speakers and listeners.

Rome Air Development Center, Griffiss AFB, N. Y.
UTILIZATION OF AIR STRUCTURES IN USAF GROUND ELECTRONIC SYSTEMS, by Albert A. Ondrejka. Aug 59, 45p. 5 refs. RADC-TR-59-137; AD-225 509.
Order from LC mi$3.30, ph$7.80 PB 143 580

This report is intended to acquaint the reader with so-called air structures which have been recently developed and show great promise for use in electronic aircraft control and warning systems. Their present status, as applicable to military operations, is reviewed in general, and prominent types are discussed more closely for the purpose of presenting their basic features and characteristics. Advantages and disadvantages associated with air structures operating under actual conditions are revealed, and recommendations regarding further development work are indicated. Properties inherent to air structures tend to suggest their wider future applications, including operations in outer space.

Sonotone Corp., Elmsford, N. Y.
INVESTIGATION LEADING TO THE DEVELOPMENT OF A NICKEL CADMIUM BATTERY HAVING A HERMETICALLY SEALED CONSTRUCTION, by Irwin M. Schulman and Paul F. Ritterman. Final rept. for 10 Aug 56-30 Nov 57 on Contract DA 36-039-sc-73009. [1957] 86p. 7 refs. AD 153 553.
Order from LC mi$4.80, ph$13.80 PB 143 664

Automatic cycling (60 minute charge - 40 minute discharge) was continued for the 3-1x1 (0.45 A.H.) batteries at discharge rates of 0.07 to 0.20 amperes. The effects of temperature, rate of charge, and electrolyte concentration on the reaction rate of the charged negative cadmium plate with oxygen in the presence of potassium hydroxide solution was investigated. Summaries of all reaction rate studies done under this contract are shown.

Sparton Radio-Television Div., Sparks-Withington Co., Jackson, Mich.
FREQUENCY METER FR-4/U, by Milton Kaufman. Final engineering rept. on Contract DA 36-039-sc-5642. 10 June 53, 86p.
Order from LC mi$4.80, ph$13.80 PB 143 752

It was determined by Sparton that the Government furnished models would not meet specifications with regard to stability, output, and spurious responses. In the proxy oscillator sub-chassis, the type of oscillator circuit has been changed to a tuned-grid type, the order of frequency multiplication is different and a substantial mechanical and electrical re-design has been accomplished. These changes have resulted in better stability and reduced spurious responses. A tuning meter has been added and the r-f output has been boosted on some bands. In addition, a separate mixer tube is now used and provides more stable operation. A CR-36/U (1250kc) crystal oscillator of a type recommended by the Signal Corps is now being used in the crystal oscillator-divider sub-chassis. A number of divider circuits were experimented with. The type now used is similar to the original design, but has been stabilized and is not free-running. In the harmonic selector sub-chassis, the blocking oscillator has been stabilized with respect to line voltage variations. Amplitude variations between harmonics have been minimized and spurious outputs from the sub-chassis considerably reduced. The function switch has been greatly simplified and the comparitor switch which was necessary in the model eliminated. The interpolation oscillator has been changed to a tuned-grid type. To improve oscillator performance coils of better Q have been wound and a large shield can be used. Mechanical design has been improved to provide better frequency stability. The indicator sub-chassis has undergone considerable change and simplification. Iron-core plate chokes have been eliminated in favor of d-c coupling to the oscilloscope deflection plates. The audio amplifier-expander has been greatly simplified and improved in performance. A negative high-voltage supply is now used for the oscilloscope and facilitates simplification of the circuits. In the power supply, a series-type regulator is used instead of the gas tubes used in the model. Better regulation under varying line voltage conditions is obtained.

Sprague Electric Co., North Adams, Mass.
FOLDED FOIL SINUSOIDAL POTENTIOMETER. Final Engineering rept. on Contract NObsr-52366. July 58, 78p.
Order from LC mi$4.50, ph$12.30 PB 143 559

Stanford Electronics Labs., Stanford U., Calif.
CIRCUIT CONSIDERATIONS IN TRAVELING-WAVE PARAMETRIC AMPLIFIERS, by C. V. Bell and G. Wade. Rept. on Contract AF 19(604)1847. 28 Aug 59, 31p. 7 refs. Technical rept. no. 316-1.
Order from LC mi$3.00, ph$6.30 PB 143 483

This paper presents the circuit considerations appropriate to wide-band operation in a traveling-wave parametric amplifier. The model which is analyzed is a transmission line periodically loaded with parametric diodes. The diodes constitute the variable elements. Across each diode is fed a large pumping voltage which produces a time-varying capacitance. A Brillouin diagram for the structure (i. e., a plot of ω vs β) can be computed from the analysis. The conditions for high gain, wide band, and other desirable characteristics are conveniently determined from this diagram.

Stanford Electronic Labs., Stanford U., Calif.
THE HELITRON OSCILLATOR, by G. Wada. Technical rept. no. 31 on Contract Nonr-225(24). 21 Apr 58, 102p. 12 refs.
Order from LC mi$5.70, ph$16.80 PB 138 586

Three different models of the helitron were constructed. The first tube showed that an operational helitron was feasible. The second tube contained modifications permitting operation at relatively large currents. These modifications also eliminated undesirable modes present in the first model. The third model had modifications leading to a better understanding of the behavior of the device. The experimental data on the three tubes are presented. A few of the pertinent experimental data are: continuous voltage tuning from 1. 2 to 2. 4 kMc with an accompanying change in tuning voltage of from 650 to 1700 volts; power output is in the vicinity of 1 to 10 milliwatts; and start-oscillation current is approximately 0. 4 ma for a structure 4 inches long.

Stanford Electronics Labs., Stanford U., Calif.
AN INVESTIGATION OF ADIABATIC RAPID PASSAGE IN IONIC PARAMAGNETS FOR USE IN SOLID-STATE MASERS, by W. W. Anderson. Rept. on Contract AF 19(604)1847. 20 Apr 59, 171p. 40 refs. Technical rept. no. 211-1; AD-220 584.
Order from LC mi$8.10, ph$27.30 PB 143 327

The theory of adiabatic rapid passage and the first applications were used in the study of nuclear magnetic moments. This study extends the results to electron spin resonance systems with emphasis on ionic paramagnets. The theory of adiabatic rapid passage is shown to apply to any two-level quantum system under the appropriate conditions. Interactions with other quantum levels and interactions not taken account of in the simple theory developed are then described by phenomenological relaxation times. It is shown that the only significant relaxation time in adiabatic rapid passage experiments is the spin-lattice relaxation time. Several types of masers are discussed.

Stanford Electronics Labs., Stanford U., Calif.
MICROWAVE INTERACTION OF ELECTRON BEAMS AND NON-PROPAGATING PERIODIC STRUCTURES, by J. A. Ruetz. Technical rept. no. 30 on Contract Nonr-225(24). 27 Mar 58, 157p. 21 refs; AD-156 783.
Order from LC mi$7.50, ph$24.30 PB 138 588

The possibility of obtaining gain in periodic non-propagating structures is investigated. The analysis makes use of an equivalent circuit representation of the microwave structure. The electron beam is assumed to flow through constant-field gaps followed by field-free drift regions. The gap voltage is associated with two different voltages of the equivalent circuit. One case assumes that the gap-voltage is the voltage appearing across a part of the shunt branch of the equivalent circuit while the other case assumes that the gap-voltage is the voltage across part of the series branch of the equivalent circuit. It is shown, by making traveling-wave tube approximations, that the first case reduces to a Bernier type analysis while the second is a Pierce type analysis.

Stanford Research Inst., Menlo Park, Calif.
FEASIBILITY STUDY OF AIRCRAFT ANTENNAS FOR FORWARD-SCATTER AND METEOR-BURST COMMUNICATION, by J. F. Cline. Rept. on Contract AF 19(604)3458. July 59, 63p. 38 refs. Technical rept. no. 66; AFCRC-TN-59-397.
Order from LC mi$3.90, ph$10.80 PB 143 398

The characteristics of the tropospheric forward-scatter and meteor-burst modes of propagation are discussed insofar as they affect the design of aircraft antennas. Considering the antenna design limitations, the existing frequency allocations, the propagation characteristics, and the cosmic and thermal noise spectra, it is concluded that the best frequency for air-ground or ground-air forward-scatter communication is about 225 Mc. It is also concluded that the best frequency for air-ground or ground-air meteor-burst communication is about 50 Mc, although frequencies up to somewhat above 100 Mc may be satisfactory for transmission in the ground-air detection. General types of aircraft antenna arrays are suggested for fore-and-aft or omnidirectional coverage, and estimates are given for the obtainable values of directive gain. Flush-mounted or slightly protruding antenna elements are recommended. Slot, patch, loop, and monopole elements are discussed in regard to size, location, and orientation. In particular, it is suggested that arrays of these elements be mounted on the fore part of the fuselage for forward transmission, and near the wing tips for fore-or-aft space-diversity reception.

Stanford Research Inst., Menlo Park, Calif.
A STUDY OF POSSIBILITIES FOR IMPROVING SPACE UTILIZATION AND PERFORMANCE OF RHOMBIC ANTENNAS, by Angel Martin-Caloto. Rept. on Contract AF 19(604)3458. July 59, 128p. 12 refs. Technical rept. 67; AFCRC-TN-59-572; AD-225 971.
Order from LC mi$6.30, ph$19.80 PB 143 404

A study of the mutual coupling of concentric rhombic antennas is made together with the analysis of the radiation properties of multiple concentric rhombics.

Stromberg-Carlson-San Diego, Calif.
DIGITAL COMPUTER INTERVENTION AND DISPLAY SYSTEM: MODEL 130, by John L. Moser. Final engineering rept. on Contract AF 08(616)81. May 58, 18p. ER-249; APGC-TR-58-82; AD-152 069.
Order from LC mi$2.40, ph$3.30 PB 138 560

The Digital Computer Intervention and Display System, Model 130, is designed to be used as an input-output device for the ERA 1103 computer. The equipment purpose is to allow fast, efficient communication between an operator and the computer, and to provide a means of high-speed photographic data-recording. A CHARACTRON Shaped Beam Tube and a series of Indicate Lights are used to display information to the operator. Activate buttons, intervention switches, and a Flexowriter (typewriter) are used to introduce information into the computer. A second CHARACTRON shaped Beam Tube is used to facilitate photographic recording.

Technical Research Group, New York.
NUCLEAR RESONANCE FILTERS FOR RADAR AND COMMUNICATIONS APPLICATIONS, by R. T. Daly and M. Newstein. Final rept. for 15 June 56-14 Sep 57 on Contract DA 36-039-sc-72408. 1957, 108p. 8 refs. AD-155 480.
Order from LC mi$5.70, ph$16.80 PB 138 551

A method of artificially "shimming" the inhomogeneous field of a small magnet by means of a series of radio frequency pulses applied to the nuclear induction sample has been investigated. The investigation was directed toward the development of a sharp, tunable, bandpass filter. Both analytical and experimental results show that two difficulties present themselves. First, the method is unstable with respect to small variations in the amplitude or width of the shimming pulses. Second, to realize a "quiet" sample under no-signal conditions, the shimming pulses must be of impractically short duration. For the case of an initial transverse relaxation time of 200 μsec, it is shown that 1000 shimming pulses must be applied during the transient signal build-up (20 millisec) in a glycerine sample if spurious output is to be kept below a reasonable level. Under these same conditions the shimming pulse length should be about 100 millimicrosec. Fractional variation in the amplitude x width value of the pulses must be held to 7×10^{-6}. A brief analysis of the steady state response of a filter is given under the assumption that the pulse qualities can be met; however, a conclusion is reached that it is impractical to meet these requirements.

Transitron Electronic Corp., Wakefield, Mass.
INDUSTRIAL PREPAREDNESS STUDY FOR DIFFUSED SEMICONDUCTOR DEVICES; DEVICE NO. 2, by B. B. Frusztajer, G. A. Ferris and H. C. Rudenberg. Feasibility rept. for 1 July 56-30 Nov 57 on Contract DA 36-039-sc-72714. [1957] 76p.
Order from LC mi$4.50, ph$12.30 PB 138 801

Feasibility of design and reproducibility of the fabrication procedures for device 2 has been demonstrated and 50 samples have been submitted for evaluation. Electrical and environmental performance tests meet the objectives. Data on 100°C storage indicates no significant deterioration over the 85°C storage temperature.

Union Thermoelectric Corp., Forest Park, Ill.
TWO DOUBLE CRYSTAL X-RAY DIFFRACTION SYSTEMS FOR SORTING QUARTZ OSCILLATOR BLANKS BY ANGLE, by James T. Lavan, Robert Mechanic and others. Special rept. on Contract DA 36-039-sc-71061. 15 July 58, 168p. 1 ref. AD-201 356.
Order from LC mi$7.80, ph$25.80 PB 144 068

Two double diffraction X-ray systems for the precision sorting of quartz resonator blanks according to angle are described together with full drawings and assembly and installation instructions. One system is designed specifically for the measurement of AT cuts. The other is more flexible, having provisions for the adjustment of the reference crystal. This second machine also employs a rotary, three-point, vacuum chuck, which could also be used with the fixed reference crystal, instead of the fixed, three-point, vacuum chuck. The use of one or the other of these chucks is important, especially for the accurate measurement of thin blanks. Both systems are designed for installation on a General Electric XRD-4 X-ray. Instructions for installing the fixed system on a General Electric XRD-2 are also given.

Varian Associates, Palo Alto, Calif.
RESEARCH ON MOLECULAR AND ATOMIC RESONANCE DEVICE, by John C. Helmer and Marcel W. Muller. Final rept. for 1 June 56-31 May 57 on Contract DA 36-039-sc-72398. [1957] 30p. 21 refs. Engineering rept. no. 189-1F; AD-143 382.
Order from LC mi$2.70, ph$4.80 PB 137 923

The properties of molecular and atomic resonance devices were investigated for use as submillimeter wave generators and/or amplifiers. Two ammonia-beam maser oscillators were constructed and tested. A maser amplifier was developed which has a gain of 20 db. The noise figure of the amplifier was measured with the aid of a novel microwave receiver which uses a maser oscillator as the second local oscillator in a double superheterodyne system. An analysis predicted the contribution of spontaneous emission to noise in maser amplifiers. The noise was considered to be a kind of thermal noise. The noise temperature of a polarized medium with n_a elements in the upper state and n_b elements in the lower states is given by $e^{h\nu/kT_e} - 1 = (n_a - n_b)/n_a$, where $h\nu$ is the energy difference between states and T_e is the temperature in question. A maser noise figure of 3.5 ± 0.5 db was measured which is constant within the experimental scatter for any gain between 18 and 32 db. A noise figure of 3.5 ± 0.1 db is predicted by the magnitude of the cavity coupling alone. The spontaneous emission noise in the beam was not observed. The possibility of developing a background gas pressure in the cavity which could contribute up to 0.7 db with an upper limit of about 0.2 db was indicated. A preliminary investigation of other molecules for use in beam-type masers indicated that the rotational energy states in linear molecules may be separated by an inhomogeneous electric field such as that used in a Townes maser.

Willow Run Labs., U. of Michigan, Ann Arbor.
RUBY AS A MASER MATERIAL, by Chihiro Kikuchi, John Lambe and others. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Mar 59, 22p. 29 refs. Rept. no. 2144-377-T.
Order from LC mi$2.70, ph$4.80 PB 143 626

The reasons for the initial choice of ruby as a maser material are outlined and some measurements of the parameters in the spin Hamiltonian and of spin relaxation times are reported. The relative merits of single and double pump modes of operation of a four-level are discussed and measurements of the oscillator power for the two cases are included.

Ordnance, Missiles, and Satellite Vehicles

Aberdeen Proving Ground, Md.
POWER REQUIREMENTS AND INTERNAL FRICTION OF GRAPHITE LUBRICATED MECHANISMS, FEED, 20mm, AN-M2 [AND] INVESTIGATION OF TORQUE AND FRICTION CHARACTERISTICS OF 20mm M2 FEED MECHANISMS, by J. R. Patchell and N. Karasik. Rept. no. 73, 23 Mar-4 Sep 53, on Ordnance proj. no. TS3-3014. 9 Oct 53, 29p. 8 refs. Includes BRL TN-801.
Order from LC mi$2.70, ph$4.80 PB 142 922

To determine the power input requirements, shaft speed, internal friction, and potential output of Mechanisms, Feed, 20mm, AN-M2, with dry graphite lubricant, and to compare power requirements and internal friction with values obtained with feeds lubricated by other methods, under conditions of both normal and extreme low temperature.

Air Force Missile Development Center, Holloman AFB, N. Mex.
CENTRAL INERTIAL GUIDANCE TEST FACILITY, I: ERROR ANALYSIS FOR THE VELOCITY MEASURING SYSTEM OF THE HOLLOMAN TRACK, by Hermann P. Greinel. June 59, 77p. 12 refs. AFMDC-TR-59-25; AD-216 525.
Order from LC mi$4.50, ph$12.30 PB 143 184

The influence of physical error sources on the accuracy of the Velocity Measuring System, correlating space and time, is investigated. As far as it is possible up to date, the errors involved in spacing and timing are calculated in the mean square sense, or estimated, at least. The predominant effect of the random yaw-motions of the sled is shown as the main result of the study. Additional effort is requested to reduce the influence of this vibrational error source. To obtain an estimate of the relative error in velocity, finally, a comparison of the formulae of Beutler and Rauch, of the Midwest Research Institute, and of Dr. Moore, STL, is carried through.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE PENETRATION OF STEEL SPHERES INTO TISSUE MODELS, by Arthur J. Dziemian. Aug 58, 43p. 14 refs. CWLR-2226.
Order from LC mi$3.30, ph$7.80 PB 143 694

The penetrations of 3/16-, 1/4-, 3/8-, and 7/16-inch steel spheres, at striking velocities up to 1000 m./sec., into 20 per cent gelatin tissue models at 10.8°C. were studied by the use of high-speed motion pictures. By integration of the equations, the velocity, time or distance of penetration at any point in the target could be calculated if the striking velocity and size and weight of the sphere were known.

Astronautics Inst., Westinghouse Electric Corp., Baltimore, Md.
PERFORMANCE OF CLOSED-LOOP FLIP-FLOP CONTROL SYSTEMS IN MISSILES AND ROCKETS, by Milton Rogers (Air Force Office of Scientific Research) and George Shapiro. 15 Apr 59, 71p. 5 refs. AFOSR-TN-59-349; AD-213 677.
Order from LC mi$4.50, ph$12.30 PB 143 593

The basic concepts underlying the synthesis and analysis of closed-loop, flip-flop control systems of the electro-mechanical type are developed. Generalized design and analysis charts are presented to aid the engineer in quickly gaining an understanding of the relative importance of various elements in the system to the system's performance and stability. The importance of considering not only control-system dynamics, but also the damping provided by the airframe in developing practical flip-flop control systems is forcefully demonstrated to the engineer and scientist. Analog computer data, obtained as part of the present study, are used to substantiate analytic approaches and to advance the understanding of such systems.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DESIGN OF AN OPTICAL INSTRUMENT (SMT) FOR SMALL, HIGH VELOCITY MISSILES, by W. J. Carrion. Aug 58, 27p. 7 refs. Rept. no. 1053.
Order from LC mi$2.70, ph$4.80 PB 138 615

The design and development of an instrument for acquiring trajectory data of small, high velocity missiles at great distances are discussed. A new optical technique for instrument alignment is described. Tests of the instrument are described and the capabilities of the instrument in a wide field of application are noted.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
DOPLOC TRACKING FILTER, by Victor W. Richard. Oct 58, 23p. 7 refs. Memo rept. no. 1173.
Order from LC mi$2.70, ph$4.80 PB 143 260

The operation and application of a phase-locked, audio frequency, tracking filter is described. The filters' primary function is to provide large improvements of the signal-to-noise ratio of noisy doppler

signals by extreme reduction of bandwidth. Bandwidths adjustable from 0.5 to 50 cps are presently available, capable of operating when the input signal is 36 db below the noise, i.e., noise power 4000 times the signal power. The center frequency of the electronic bandpass filter tracks the input frequency by means of a phase-locked servo loop. A unique feature of the filter is the employment of a third order servo control system which makes it possible to maintain lock-on to the signal under dynamic flight conditions, thus obtaining maximum signal-to-noise improvement by permitting use of narrowest possible bandwidths.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INSTRUMENTATION, FLIGHT SUMMARIES AND ASPECT DATA OF NIKE-CAJUN ROCKETS OB6.04, OB6.06 AND OB6.15, by Spence T. Marks and Joseph M. Conley. Upper Atmosphere Research rept. no. 8, June 59, 34p. 7 refs. Memo. rept. no. 1214.
Order from LC mi$3.00, ph$6.30 PB 143 146

A series of Nike-Cajun rocket firings for the purpose of conducting magnetometer experiments to an altitude of 140 km are described. Flight objectives are enumerated. The nose cone instrumentation is described in some detail. Flight summaries for the three rockets are given. Aspect magnetometer data are also presented. The precession magnetometer data are being reduced, and will be the subject of a separate report. The firings here reported were part of a series conducted by these Laboratories during the International Geophysical Year, and were supported in part by the National Science Foundation under NSF Grant Number Y/10.14/151.

Defense Research Lab., U. of Texas, Austin.
THE EQUATIONS OF MOTION OF AND EQUIVALENT CIRCUITS FOR A GEOPHONE, by C. W. Horton. Rept. on Contract DA 44-009-eng-2073. 18 Oct 54, 23p. 2 refs. DRL Acoustical rept. no. 84.
Order from LC mi$2.70, ph$4.80 PB 143 731

Defense Research Lab., U. of Texas, Austin.
A PRELIMINARY STUDY AND ANALYSIS OF THE MECHANICAL-ACOUSTICAL IMPEDANCE OF THE EARTH, by E. L. Hixson and J. F. Mifsud. Final rept. on Contract DA 44-009-eng-2073. 21 Aug 56, declassified 14 Mar 58. 70p. 21 refs. DRL-A-111.
Order from LC mi$3.90, ph$10.80 PB 143 726

A device has been built which measures the driving-point impedance of the ground from 50 cps to 350 cps. The experimental dependence of the driving-point impedance on soil parameters such as particle size, moisture content, and density has been measured. Discontinuities in the ground such as cracks or stratifications show up as circles or loops on the complex impedance plot and also change the magnitude of the impedance, particularly at the low frequency end. The impedance increases over a buried mine if the mine is less compliant than the soil in which it is buried and vice versa. Some experimental results also are given on the dependence of the driving-point impedance on the size of the driving piston and the magnitude of the static and dynamic force. Equivalent electric circuits of the driving-point impedance are discussed. In agreement with the recommendation of the Panel on Acoustic Detection of Buried Land Mines, it is suggested that an automatic impedance recording device be constructed. This new system could be used for both a more complete study of the driving-point impedance of soils and buried objects and the measurement of transfer admittance.

Defense Research Lab., U. of Texas, Austin.
A STUDY OF THE PROPAGATION OF SOUND WAVES NEAR THE SURFACE OF THE EARTH AND THE MEASUREMENT OF THE DRIVING-POINT IMPEDANCE OF THE EARTH, by W. R. Runyan and J. F. Mifsud. Interim technical rept. on Contract DA 44-009-eng-2073. 10 Mar 55, declassified 12 Mar 58, 57p. 33 refs. DRL Acoustical rept. no. 88.
Order from LC mi$3.60, ph$9.30 PB 143 730

The work already accomplished consists of (1) the design of a system which will measure the driving-point impedance of the ground in the frequency range of 50 to 350 cps, (2) the measurement of the driving-point impedance of a silty sand and a clay soil as a function of frequency, and (3) a few measurements of the velocity of the Rayleigh wave on the surface of a semi-infinite soil.

Defense Research Lab., U. of Texas, Austin.
THE STUDY OF SOME ACOUSTIC PROPERTIES OF SOILS, by S. J. Brient and E. L. Hixson. Final technical rept. on Contract DA 44-009-eng-2875. 30 30 Sep 57, declassified 14 Mar 58, 49p. 5 refs. DRL Acoustical rept. no. 128.
Order from LC mi$3.30, ph$7.80 PB 143 724

The performance of any acoustic buried mine detector depends on the acoustic properties of soils. A study of the surface characteristics has been made using the impedance concept. Several devices have been developed for measuring force and the resulting velocity and an automatic computer-recorder has been built to calculate and plot impedance as the measurement is made. Driving-point impedance measurements have been made over several buried objects and the surface characteristics noted. In a study of the problem in increasing detector range some transfer impedance and velocity transfer functions have been measured. Impedance information has been used to predict the transient response of a soil to an impulsive force and the results verified experimentally. The results and information collected have been applied to the detection problem and some acoustic mine detection principles are presented.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
OPTIMUM SEARCH PROCEDURES: DISCRETE CASE, by Frank Proschan and William Pruitt. Rept. on Contract DA 36-039-sc-73170. 1 Aug 57, 24p. Technical memo. no. EDL-M112; AD-153 346.
Order from LC mi$2.70, ph$4.80 PB 138 565

Optimum search procedure is derived mathematically. An enemy missile is assumed to arrive at some time and in some location with some corresponding probability which is uniform over time. Detection of the enemy plane occurs with some fixed probability w when the search equipment scans its location. The resultant gain is some specified function of time arrival and detection. Proof is given that the scans devoted to a given location should be regularly spaced over time. The ideal proportion of scans devoted to a given location is determined explicitly as a function of the probability of missile arrival in the given location. For a large class of payoff functions, the ideal proportion of scans allocated to the i^{th} location is proportional to a corresponding power of the probability p_i. The solution does not depend on the probability of detection. A numerical example for a 6-location case is given to compare the ideal procedure with alternative procedures. Actual search schedules are presented.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
CHARACTERISTICS OF VARIOUS METHODS OF COLLECTING DATA IN TESTS OF INCREASED SEVERITY, by Alonzo Bulfinch. Aug 59, 24p. 10 refs. Technical rept. 2627.
Order from LC mi$2.70, ph$4.80 PB 143 720

The need for a better understanding of the characteristics of methods for collecting data in tests of increased severity is described. A number of problem areas in Ordnance research are listed in which tests of this kind are required. Characteristics of various standard methods and some of their modifications have been studied by Monte Carlo techniques. The results of sampling known normal and skewed distributions are evaluated. The relation of tests of increased severity to reliability testing is pointed out.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF UNIVERSAL HIGH-ALTITUDE, HIGH-TEMPERATURE-RESISTANT SQUIBS WITH AND WITHOUT RF AND MF PROTECTION, by Charles Knapp. Oct 59, 30p. 11 refs. Technical rept. 2653; AD-226 825.
Order from LC mi$2.70, ph$4.80 PB 142 488

Prototypes of universal high-altitude, high-temperature-resistant squibs both with and without RF and microwave frequency (MF) protection, have been developed. They are designed to endure such outer space conditions as temperatures of 200°C; vacuums of 10^{-8} mm mercury; and the vibration, acceleration, and shock of rocket launching and flight. Outstanding features of the new squibs are the hermetic sealing of the charge compartment and the use of materials of very low vapor pressures--stainless steel, Kovar, and glass or ceramics.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J
EXPERIMENTAL VERIFICATION OF EXPRESSION FOR RATE OF FALL OF PARACHUTE-SUSPENDED FLARE, by Matthew Nowak and Jesse F. Tyroler. July 59, 18p. Technical rept. 2623; AD-214 769.
Order from LC mi$2.40, ph$3.30 PB 143 320

An expression for the distance traveled as a function of time for a flare assembly suspended from a parachute was derived on the basis of the assumption that the frictional drag is expressible as a function of the velocity ($M=KV^2$). This expression was verified by comparing values obtained from it with experimental values. The derived values agreed with the experimental data to within less than 5%. The work done makes possible the use of the expression with a known degree of confidence.

Feltman [Research and Engineering] Labs., Picatinny Arsenal, Dover, N. J.
THE MECHANISM OF IGNITION AND PROPAGATION OF OXIDANT-METAL FLASHES, by Joseph Hershkowitz. Apr 58, 46p. 6 refs. Technical rept. 2526; AD-156 424.
Order from LC mi$3.30, ph$7.80 PB 138 639

The physics of a system consisting of a small quantity of explosive, centrally located in a case containing an oxidant/metal flash composition has been qualitatively described on the basis of an experimental study.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
QUANTITATIVE STUDY OF PARAMETERS AFFECTING BULLET SENSITIVITY OF EXPLOSIVES, by Samuel D. Stein. Sep 59, 63p. 7 refs. Technical rept. 2636; AD-226 111.
Order from LC mi$3.90, ph$10.80 PB 143 822

Rifle-bullet sensitivity tests (Caliber .30) were conducted to determine the extent to which explosive-column length, thickness of confining wall, and kind of wall material affect the bullet sensitivity of commonly used explosives. Also studied was the feasibility of evaluating the test results quantitatively by measuring the magnitude of the shock wave generated when an explosive detonates.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
STATIC TEST DEVICE WHICH SIMULATES GUN-FIRING PRESSURE ON BASE OF SHELL, by Samuel D. Stein, Stanley J. Lowell, and Richard W. Snook. Aug 59, 38p. 3 refs. Technical rept. 2640.
Order from OTS $1.00 PB 151 801

The device consists principally of a test chamber in which a propellant charge is fired, a locking mechanism to hold the test specimen in position, ventings, and auxiliary component parts and instrumentation. The device generates pressures up to 50,000 psi over a period of approximately 1 to 2 milliseconds. In addition to simulating the conditions to which the bases of shell are subjected during gun firing, the device can be used to study the strength and permeability of materials and joints under high pressures at ultra high rates of loading and to study the strength of materials under rapid compression. Its use should eliminate costly gun firing tests.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
THERMOANALYSIS OF BINARY SYSTEMS: $KClO_4$/ALKALI AND ALKALINE EARTH METAL NITRATES, by Virginia D. Hogan and Saul Gordon. Sep 59, 29p. 6 refs. Technical rept. 2608.
Order from LC mi$2.70, ph$4.80 PB 143 903

To investigate the high temperature physicochemical behavior of binary oxidant mixtures containing potassium perchlorate and the nitrates of the alkali and alkaline earth metals (lithium, sodium, potassium, rubidium, cesium, calcium, and strontium).

Institute for System Research, U. of Chicago, Ill.
DETERMINING AIR REACTIONS ON MOVING VEHICLES. PART III. METHODS OF HYDRODYNAMICS, by M. Z. Krzywoblocki. Rept. on Contract AF 33(616)5689. July 59, 217p. 820 refs. WADC Technical rept. 56-51, Pt. 3.
Order from OTS $3.50 PB 161 141

The present report describes briefly the most important methods of hydrodynamics to calculate the forces and moments acting on a body moving in a fluid which is at rest or on a body at rest in a moving fluid. Only the most distinguished features of each method under discussion are presented. The report is divided into two parts: incompressible and compressible fluids. Each part contains a separate list of references and separate numeration of equations. Along with the discussion of the most advanced methods in each part there are briefly mentioned some more advanced papers on the subject in question. Under the definition of "hydrodynamic methods" we understand the mathematical methods which have a full rigor of analysis. This implies that all the methods discussed in this report have mathematical justification and no approximative assumptions of an intuitive nature are introduced.

Institute of Molecular Physics, U. of Maryland, College Park.
ELECTRONIC TRANSIENT RECORDER FOR TRACKING OF HIGH SPEED PROJECTILES, by D. Ritke and E. White (Naval Ordnance Lab.). Rept. on Contract Nonr-595(02). 19 Nov 58, 33p. 12 refs. IMP-ONR-1.
Order from LC mi$3.00, ph$6.30 PB 143 457

A microwave interferometer system which is used to follow the motion of a high speed projectile is described. A block diagram is given for the complete apparatus as well as diagrams for the component units. The system described here differs in some respects from other microwave systems reported in the literature.

Integrated Range Mission, White Sands Missile Range, N. Mex.
A HIGH FREQUENCY DIRECT-WRITING RECORDER, by Robert C. Barto. 15 July 58, 43p. 5 refs.
Order from LC mi$3.20, ph$7.80 PB 143 357

A direct-writing analog recorder has been developed to provide "quick-look" recordings of telemetry data. The instrument produces high-resolution oscillogram records on electrophotographic paper. A xerographic process is used that allows a continuous and automatic processing of the record in the instrument. The result is a permanent record made without the use of wet chemical processing. The permanent, high-contrast record can be reproduced by Ozalid or Bruning processes, as well as photographically. Sensitizing, exposing, developing, and fixing are accomplished at paper speeds of one-half inch per second to sixteen inches per second. After exposure, the developed record can be viewed in the time required for four inches of chart movement. This corresponds to eight seconds for the slowest paper speed and one-quarter second for the highest paper speed.

Naval Ordnance Lab., Corona, Calif.
DESIGN CONSIDERATIONS IN THE USE OF SOLENOIDS IN SAFETY-ARMING DEVICES, by W. B. Lunt and R. E. Tafel. 3 Sep 59, 50p. NAVORD rept. 5952; NOLC rept. 451.
Order from LC mi$3.30, ph$7.80 PB 144 111

In a certain guided missile safety-arming device (S-A), reopening of the once-activated solenoid circuit caused the coupling of large transient voltages into the otherwise independent detonator circuit, and resulted in premature initiation. These electrical difficulties stemmed solely from the use of a solenoid as the S-A launch-latch actuator. This report details the investigation of the S-A in question and discusses the results obtained. Various corrective measures are considered, and recommendations are made for incorporating such improvements in future S-A's.

Naval Ordnance Lab., White Oak, Md.
UNDERWATER SHOCKWAVE PARAMETERS FOR TNT, by John P. Slifko and Thomas E. Farley. 1 June 59, 27p. 16 refs. NAVORD rept. 6634.
Order from LC mi$2.70, ph$4.80 PB 143 823

Free water shockwave parameters obtained from 80-pound spherical TNT charges, covering the scaled reciprocal range of $W^{1/3}/R$ from 0.08 to 0.6 $lbs^{1/3}/ft$, and similitude lines for peak pressure, time constant, impulse and energy are presented.

Naval Ordnance Test Station, China Lake, Calif.
SEA ANIMALS AND TORPEDOES, by William C. Shaw. 10 Aug 59, 49p. 103 refs. NOTS TP-2299; NAVORD-6573; AD-226 362.
Order from LC mi$3.30, ph$7.80 PB 143 824

Various aspects of sea-animal locomotion are surveyed in the light of the tactical propulsive requirements placed upon torpedoes. Intensive investigation looking toward the eventual application of the fundamental principles of locomotion that are utilized by the sea animals (without necessarily imitating their structure) is believed to offer a new

avenue of approach toward achieving the silent and efficient operation that is so essential for effective homing and stealth.

Naval Proving Ground, Dahlgren, Va.
SATELLITE TRAJECTORY AND ORBIT CALCULATIONS FROM MINITRACK TRIANGULATION, by W. A. Kemper. 8 Dec 58, 62p. 6 refs. NPG rept. no. 1633.
Order from LC mi$3.90, ph$10.80 PB 138 538

This work was undertaken to provide information on the performance of the Vanguard satellite launching vehicles during the third stage burning and also to provide a back-up prediction of the orbit or trajectory from simultaneous Minitrack data taken at Grand Turk and Antigua. The report describes the calculation procedures used and the results obtained through May 1958. The calculations are made in three steps. First, position coordinates are obtained by a least squares triangulation using simultaneous data from the two stations. Then a "best" fit is made to the position coordinates using orthonormal polynomials, and smooth position, velocity and acceleration are obtained. With these data as initial conditions, trajectories are integrated around an oblate spheroidal earth with a gravity field corresponding to the figure of the earth. Results are given for 1958 α and β and on the orbit attempts of Explorer II and SLV 1.

[Naval Weapons Plant] Washington, D. C.
THE DESIGN OF AN ELECTROMECHANICAL SERVOMECHANISM WITH PHOTO ELECTRIC ERROR DETECTION, by Ralph C. Liebowitz and Seymor Kant. 30 June 49, issued 5 Jan 58. 89p. 6 refs. Technical rept. no. NGF-T-42-57; NAVORD rept. no. 5526; AD-152 772.
Order from LC mi$4.80, ph$13.80 PB 138 596

A servomechanism has been designed using two independent servo loops with a photoelectric cell as the error detecting device. Mathematical analysis shows that if the angle of rotation of the mirror which reflects light to the photocell along two orthogonal paths does not exceed 20 minutes then the two servo loops are mutually independent and the photocell voltage output will be a linear function of the error angle for each servo. The servomechanism has been designed by means of the "decibel-log-frequency" type of synthesis and a detailed mathematical analysis shows that the design specifications are satisfied.

Picatinny Arsenal, Dover, N. J.
DICTIONARY OF EXPLOSIVES, AMMUNITION AND WEAPONS (GERMAN SECTION) by Basil T. Fedoroff, Henry A. Aaronson and others. 1958 [declassified 20 July 59]. 352p. Technical rept. no. 2510.
Order from OTS $4.00 PB 161 270

This compilation has been made with the object of providing a ready reference to the subject matter covered by means of an alphabetical arrangement. In general, only sufficient information is furnished for understanding of the principles, meaning of terms, process, mechanical layout etc. Numerous references to original sources are provided for those seeking more detailed information. Classified information has been carefully excluded. However, a few classified references have been given to permit further study by those with authorized access to such sources. No attempt has been made to include all data and information available to the Ordnance Corps.

Rock Island Arsenal Lab., Ill.
GAMMA RADIATION OF PACKAGING MATERIALS, by W. F. Garland. 31 July 59, 19p. 19 refs. Rept. no. 59-2056.
Order from OTS $0.50 PB 161 097

This report summarizes the results obtained from exposing ten barrier materials or component parts over a dose range of 1.4×10^6 to 30.1×10^6 Rad. Spent reactor fuel elements were used as the source of gamma (ionizing) radiation. The study was of an exploratory nature. Although all materials were degraded somewhat by the highest dose of radiation, the plastic films seemed to be the least affected. Among the materials evaluated, cotton scrim was the poorest of the materials, losing approximately 60% tensile strength at 30.1×10^6 Rad.

Springfield Armory, Mass.
UTILIZATION OF INVESTMENT CASTINGS FOR SMALL ARMS WEAPON COMPONENTS, by J. F. Panda. 26 June 59, 42p. Rept. SA-TR19-1004.
Order from OTS $1.25 PB 161 268

An investigation was conducted to determine the feasibility of using investment castings for components of various small arms weapons. Description of the procedure used in fabricating components by the investment casting method is discussed.

Systems Labs. Corp., Sherman Oaks, Calif.
THE GEODETIC USE OF ARTIFICIAL EARTH SATELLITES. Final rept., Pt. 1, on Contract AF 19(604)5517. 15 Aug 59, 127p. 53 refs. CMCC 24.9; AFCRC-TR-59-276, Pt. 1.
Order from OTS $2.75 PB 161 147

This report discusses various ways in which an artificial earth satellite may be used to provide the geodesist with more accurate information about the relation between different geodetic datums. The various available methods are discussed both from a general point of view and in terms of a number of specific methods which have been proposed for this purpose. These include both optical and electronic techniques and in each case the predicted accuracy of the principal datum ties is discussed. Connection methods based both on orbit prediction and on simultaneous visibility of the satellite from the datums are investigated. The report is divided into two parts; Part I presents a general, non-mathematical discussion of the problems and methods and summarizes our principal conclusions; Part II presents a more detailed technical analysis of the accuracy of various methods, of equipment design and performance and of the effects of physical phenomena, such as ionospheric and atmospheric fluctuations, on the measurements.

Systems Labs. Corp., Sherman Oaks, Calif.
THE GEODETIC USE OF ARTIFICIAL EARTH SATELLITES. Final rept., Pt. 2, on Contract AF 19(604)5517. 15 Aug 59, 87p. 51 refs. CMCC 24.10; AFCRC-TR-59-276, Pt. 2.
Order from OTS $2.25 PB 161 148

This part of the report constitutes a technical appendix to Part I, and a number of mathematical and technical questions are analyzed in some greater detail here. There has not been any attempt made to ensure continuity between the sections here, and apart from the first three each may be read largely without reference to the others. As far as possible the notation has been kept consistent, and with some exceptions conforms to conventional usage. (See also PB 161 147)

Sanitation and Safety Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
DEVELOPMENT OF THE CLOSURE, PROTECTIVE SHELTER, ANTIBLAST, 600 CFM, E19R1, PART I, by Frank G. Ort and Merton D. Mears. Jan 59, 72p. 5 refs. CWLR-2269.
Order from LC mi$4.50, ph$12.30 PB 143 718

This report covers the development of the Closure, Protective Shelter, Antiblast, 600 cfm, E19R1. The unit was designed for use in the inlet and exhaust ducts of CBR protective shelters to provide protection against blast effects for personnel, filter units, ducts, and installed equipment. The closure unit is applicable to flows other than the design flow capacity of 600 cfm. The E19 antiblast closure, and its improved version the E19R1, satisfactorily met the special and protective requirements established by the Bureau of Yards and Docks, Department of the Navy. Shock-tube tests on the units were conducted at APG and its successful performance in the field under conditions of an atomic exposure at the Nevada Proving Ground is described. A plan for further work to provide additional engineering design and performance data for this type of antiblast closure is given.

Naval Research Lab., Washington, D. C.
ALGAE AND SUBMARINE HABITABILITY: AN APPRAISAL, by John M. Leonard. 26 Aug 58, 9p. 17 refs. Rept. 5182.
Order from LC mi$1.80, ph$1.80 PB 134 259

The feasibility of using algae in submarine air purification has been explored through an examination of the scientific literature. Without minimizing the serious biological and engineering problems, the writer believes that the prospects warrant serious experimental investigations. An estimate of 300 to 440 kilowatts is offered as the power requirement of the system. Various possible sources of illumination are examined. The writer recommends the seeking out of algae of optimum properties, the search to include chemical- and radiation-induced mutants. Chemical growth-stimulators should be closely studied. Construction of a pilot-plant exchanger would furnish valuable engineering experience.

Naval Research Lab., Washington, D. C.
A SOLID-PROPELLANT PRESSURIZER FOR FIRE-EXTINGUISHING SYSTEMS IN POLAR REGIONS, by J. K. Musick and J. A. Grand. Final rept. 3 Aug 59, 29p. 8 refs. NRL rept. 5332.
Order from OTS $0.75 PB 151 737

A solid-propellant pressurizer with an automatic firing device for a 300-gallon sprinkler system has been developed. The unit is designed to operate from -65°F to room temperature. One 300-gallon sprinkler system can provide fire protection for two 20 x 48 ft buildings. The pressurizer employs the combustion gases of a double-base propellant to expel the extinguishant. The propellant is shaped into a hollow cylinder, 3-1/4 inches in diameter and 4-1/2 inches long. These cylinders, or grains, can be burned either singly or coaxially in groups of two or three. This feature, with the selection of suitable nozzles and other hardware, permits the use of different sizes of cartridges while retaining the advantages inherent in the use of a single propellant-grain design. The use of different sizes of cartridges is advantageous, since the volume of space to be pressurized varies widely as the operation of the sprinkler system proceeds. The cartridges are fired at the proper time and in the proper sequence by a battery-powered firing system which employs two pressure switches and a stepping relay, and which is triggered by pressure changes in the sprinkler tank and loop. To initiate operation, a supervisory pressure of 10 to 15 psi is maintained in the sprinkler loop. When this pressure is reduced to 5 psi by the opening of one or more sprinkler heads, the first cartridge is fired. The high pressure (about 100 psi) resulting from the combustion of the first cartridge arms the firing system preparatory to firing the second cartridge. When enough fluid has been expelled through the open heads to reduce the pressure in the system to a predetermined level (about 35 psi), the second cartridge is fired. The process is then repeated automatically until all the cartridges are fired or until the line switch is opened manually. It appears that four cartridges will be sufficient for a 300-gallon system, although the use of a greater number would not require any basic changes in design.

Ship Building

Bureau of Yards and Docks, Washington, D. C.
TOWING NONSELF-PROPELLED FLOATING STRUCTURES. 1 Oct 53, 74p. Technical Pub. NAVDOCKS TP-Pw-26.
Order from OTS $2.00 PB 161 255

This publication has been prepared as a technical guide for naval and civilian personnel concerned with the preparation for towing of all floating craft within the Bureau's area of technical responsibility. Presented herein are the technical criteria used in the design, planning, and installation of towing equipment.

Experimental Towing Tank, Stevens Inst. of Tech., Hoboken, N. J.
METHODS FOR ESTIMATING THE LONGITUDINAL AND LATERAL DYNAMIC STABILITY OF HYDROFOIL CRAFT, by Paul Kaplan, Pung N. Hu, and Stavros Tsakonas. Rept. on Contract Nonr-263(14). May 58, 86p. 23 refs. Rept. no. 691.
Order from LC mi$4.80, ph$13.80 PB 143 133

The equations of motion of tandem hydrofoil craft in both longitudinal and lateral modes, each mode having three degrees of freedom, are derived on the basis of the linear theory of small disturbances. Various stability derivatives appearing in the equations are determined in terms of the lift and drag forces acting at the foils, together with their derivatives with respect to angle of attack and depth. Various theoretical and experimental methods for determining these hydrodynamic quantities are discussed in the report. Stability criteria for both the longitudinal and lateral dynamic stability of hydrofoil craft also are presented. The results may be used for estimating the dynamic stability of hydrofoil craft while in the preliminary design stage, and it is expected that the equations are sufficiently accurate to indicate the trends in the degree of dynamic stability as changes are made in the design configuration.

Experimental Towing Tank., Stevens Inst. of Tech., Hoboken, N. J.
SHIP BEHAVIOR AT SEA, LECTURE NOTES ON: SECOND SUMMER SEMINAR HELD AT STEVENS INST. OF TECH., JUNE 16-20, 1958. Rept. on Contracts Nonr-263(10, 19). Nov 58, 188p. 62 refs. Rept. no. 708.
Order from LC mi$8.40, ph$28.80 PB 143 481

Institute of Engineering Research, U. of California, Berkeley.
MARITIME CARGO TRANSPORTATION, L. M. Tichvinsky. Final rept. on Contract Nonr-222(36). Oct 58, 7p. 4 refs. Series no. 105, issue no. 3.
Order from LC mi$1.80, ph$1.80 PB 143 793

Iowa Inst. of Hydraulic Research, Iowa City.
ROLL DAMPING DUE TO BILGE KEELS, by Milton Martin. Rept. on Contract Nonr-1611(01). Nov 58, 63p. 24 refs.
Order from LC mi$3.90, ph$10.80 PB 143 734

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Forest Products Lab., Madison, Wis.
DEVELOPMENT OF A CASE LINER FOR LONG-TERM OUTDOOR STORAGE (FOURTH-YEAR INSPECTION), by Louetta Dieruf and Donald J. Fahey. June 59, 32p. Rept. no. 55-2-4.
Order from LC mi$3.00, ph$6.30 PB 143 280

This is the fourth in a series of reports made after annual examinations of 10 boxes and their contents returned from each of 4 outdoor exposure sites. Results of this fourth-year examination indicate that, of the three species of pretreated wood considered for use as boxes, Douglas-fir best protected the liner and its contents, and red oak was the least effective. The liner of polyethylene film, foil, and scrim was still superior to the liners consisting of polyethylene film and kraft paper combinations. Of the four sites, Panama's high temperature and moisture had the most detrimental effect on boxes, liners, and contents.

Food

Alabama U., University.
FACTORS CONTRIBUTING TO FOOD MONOTONY, by Paul S. Siegel. Rept. no. 5 (Final) for 7 Feb 55-6 July 56 on Contract DA 19-129-qm-264. [1956] 19p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 143 782

The present study was specifically designed to generalize to other and different menus the finding that acceptance declines with repetition, to re-examine the relationship between acceptance decline and initial palatability, to evaluate two different psychological tests as possible predictors of susceptibility to monotony, and to assess certain selected dehydrated and frozen items with respect to monotony production. Additionally, opportunity was found to pursue several fresh leads or hypotheses.

California U., Berkeley.
CAROTENOID STABILITY OF CARROTS, by G. MacKinney. Rept. no. 1 (Final) for 3 June 55-31 Dec 56 on Contract DA 19-129-qm-420. [1956] 12p. QFCIAF File no. V-327.
Order from LC mi$2.40, ph$3.30 PB 143 777

Three main lines of research were followed: (1) Impregnation of the diced carrot with a suitable antioxidant prior to dehydration. (2) Use of an oxygen scavenger added to the container in which the dehydrated product was to be stored. (3) Use of high vacuum, 28.5-29 inches, as encountered in the coffee industry packs. Of the three procedures, the last mentioned was successful. Samples stored at 104, 122, 140° F (40, 50, 60° C, respectively) showed no change in carotene content after three months in the absence of oxygen. By contrast, results with the antioxidant, propyl gallate, showed only partial protection of the pigment. Tests with the oxygen scavenger made at the request of the Quartermaster Food and Container Institute were inconclusive for various technical reasons not subject to our control. In principle it would appear also to be a workable procedure for eliminating the oxygen from the container.

Cremer, H. D.
STUDIES AND INVESTIGATIONS ON THE REQUIREMENTS OF VITAMIN B_1 IN DIFFERENT DIETS, by H. D. Cremer. Final technical rept. for 1 Sep 58-31 Aug 59 on Contract DA 91-508-EUC-374. [1959] 19p. 13 refs.
Order from LC mi$2.40, ph$3.30 PB 143 449

The method as developed for thiamine determination in urine was proved on its accuracy and specifity as well as tested on its appropriatness of vitamin B_1-determination in food-stuffs. It was the purpose of these investigations to study if sorbitol administration improves the maintenance of thiamine in the human in a similar way as found in the rat. It is concluded from these studies that sorbitol administration in the human and in the rat effects a stimulation of the thiamine synthesis of the intestinal microorganisms. Since absorption in the lower digestive tract is decreased, the main part of the intestinal vitamin production can not be utilized in the human, while an utilization takes place in the rat by coprophagia.

Food and Drug Research Labs., Inc., Maspeth, N. Y.
THE DEVELOPMENT OF METHODS FOR THE MEASUREMENT OF VITAMIN A IN PACKAGED RATIONS, by Kenneth Morgareidge. Rept. nos. 10, 11, and 12 (Final) for 1 June 55-31 May 57 on Contract DA 19-129-qm-392. [1957] 26p. File no. N-1127.
Order from LC mi$2.70, ph$4.80 PB 143 780

Two satisfactory methods for the determination of Vitamin A in packaged rations have been developed. One employs a single magnesia-celite column for partial isolation of the vitamin from a hexane extract of the unsaponifiable fraction of the food. Vitamin A is estimated on the basis of its blue color reaction with antimony trichloride. The second method is a refinement of the first in that the eluate from the magnesia column is further purified by re-chromatographing on weakened alumina after which the vitamin A content is determined by ultraviolet spectrophotometry.

Illinois U., Urbana.
ISOLATION AND IDENTIFICATION OF THE STALE-FLAVOR COMPONENTS WHICH DEVELOP IN DRY WHOLE MILK (AS A RESULT OF RADIATION), by R. McL. Whitney. Rept. no. 5 (Final), 26 June 55-25 June 57, on Contract DA 19-129-qm-483. [1957] 35p. 21 refs. File no. D-319.
Order from LC mi$3.00, ph$6.30 PB 143 776

New or modified fractionation techniques were developed for concentrating the stale-flavor components, and the following information was secured concerning the chemical and physical properties of the stale flavor: (1) The stale-flavor components are soluble in butteroil, petroleum ether, alcohol, CCl_4, and CS_2 but are relatively insoluble in water or 50% aqueous alcohol. (2) They distribute themselves between the various fractions of stale reconstituted milk according to the amount of butteroil in the fractions. (3) They are apparently not acid or γ - and δ - decalactones. (4) They are volatile with steam or CCl_4-vapor at both atmospheric and reduced pressures, but their volatility varies with the particular material being investigated. (5) Seven p. p. m. of the pertoleum-ether-soluble fraction of the steam distillate is sufficient to produce a detectable stale flavor in fresh milk. (6) The infrared adsorption spectra of the CS_2 and CCl_4 extracts of the steam distillate of stale fats indicate that the stale-flavor components may contain the following groups: $-CH_3$; $-CH_2-$; ester or lactone C = O; aldehyde or ketone C = O; aliphatic ether $-\overset{|}{C}-O-$; unsaturated ether -C-O-; and cis $-\overset{H}{\overset{|}{C}} = \overset{H}{\overset{|}{C}}-$ or $>C = CH_2$.

The storage study of the irradiated dried whole milk indicated that the irradiated products were always described by the judges as gluey, burnt, or scorched while the control samples were considered typically stale. Thus the two flavors were not the same or similar. The flavor of the irradiated samples did not change in character on storage but continued to increase in intensity throughout the storage period. Neither temperature of storage nor irradiation dosage appears to have a consistent effect upon the flavor of the irradiated samples.

Oregon State Coll. Agricultural Experiment Station, Corvallis.
RESISTANCE OF MICROORGANISMS TO IONIZING RADIATION APPLIED TO FOOD, by P. R. Elliker. Rept. no. 6 (Final) for 15 Aug 56-14 Aug 57 on Contract DA 19-129-qm-730. [1957] 33p. 1 ref. QFCIAF File no. S-547; AD-154 835.
Order from LC mi$3.00, ph$6.30 PB 138 804

Microbial examination of meat and poultry products revealed microorganisms that can survive radiation intensities considered to be in the sterilization range. Samples examined at 20 weeks' storage showed varying degrees of decomposition, either enzymatic or bacterial in nature. Combinations of irradiation and antibiotics may have some value if the irradiation level is less than 10^6 rep (930,000 rad) and the level of the antibiotic high enough to leave an effective residual quantity. Recent investigation has revealed that the antibiotics are destroyed at the proposed sterilization dosages and in some instances may actually offer some protection to the microorganisms. With the exception of salt none of the commonly used preservatives have shown promise in inhibiting growth of radiation-resistant bacteria because of the high levels required for the radioresistant cocci. It may be possible to inhibit the organisms with low levels of salt (sodium chloride). The combination of heat and radiation has not proven effective in sterilizing food material, unless both high temperature and high levels of radiation are used. Our results to date indicate that heat which will inactivate most enzymes does not destroy the sporeforming species.

Southern Research Inst., Birmingham, Ala.
STUDY OF FLAVOR AND CHEMICAL CHANGES IN FOODS DURING STERILIZATION BY IRRADIATION, by Robert E. Burks, Jr. Rept. no. 8 (Final), 1 Sep 56-31 Oct 57, on Contract DA 19-129-qm-740. 7 May 58, 44p. 16 refs. File no. S-530.
Order from LC mi$3.30, ph$7.80 PB 143 775

This is a summary report on work done to elucidate the chemistry of the characteristic flavor of irradiated beef. Gas-chromatography confirmed the conclusion that methylamine, ethylamine, ammonia, and other amines are produced by the irradiation of beef. Radiation lowers the respiration rate of beef. The total volatile-base content of irradiated beef definitely increased during storage. The changes in water-extractable carbonyls, hydrogen sulfide, and methyl mercaptan conformed less closely to a definite pattern. The deactivation of enzymes by heating had some benefit in improving the flavor of stored irradiated beef. Exhaustive lyophilization failed to deodorize beef, so much of the odor must be caused by large molecules or compounds which are constantly being released.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Rodman Lab., Watertown Arsenal, Mass.
EVALUATION OF ALLOY BINDER SYSTEMS IN CEMENTED CARBIDES, by James E. Mahaffy and William O. Woods. Feb 59, 28p. 5 refs. Rept. no. RPL-43/1.
Order from OTS $0.75 PB 161 122

Tungsten carbide prepared with alloy binders in the ranges investigated exhibits strength properties which are generally inferior to straight cobalt bonded tungsten carbide. Binder alloys of cobalt-iron and cobalt-iron-nickel would be suitable for applications where high hardness is a necessary critical requirement and high transverse rupture strength is of secondary importance.

Engines and Propulsion Systems

Army Transportation Research and Engineering Command, Fort Eustis, Va.
MULTIFUEL-DIESEL-ENGINE TRUCK, by Joseph T. Gurganious and Rodney L. Berriker. Final rept. on Project 9-47-16-000, Test MT-12. July 59, 31p. AD-214 496.
Order from OTS $1.00 PB 161 114

This report compares the capabilities of a multifuel diesel engine and a standard gasoline engine. Two Trucks, Tractor, 2-1/2-Ton, 6x6, M48, were tested: one was equipped with the multifuel diesel engine; the other retained the standard gasoline engine. Three test routes were selected. Each was traversed six times (five times with the multifuel-diesel-engine truck, each time using a different type of fuel, and one time with the standard M48 truck using Army gasoline). Results of the tests prove that the multifuel diesel engine has a remarkably lower fuel consumption, as well as a much higher performance rating, than the standard gasoline engine of comparable power.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF AXIAL COMPRESSORS WITH ASYMMETRIC INLET FLOWS, by Robert Katz. Final rept. on Contract AF 18(600)178. June 58, 158p. 16 refs. AFOSR-TR-58-89; AD-162 112.
Order from LC mi$7.50, 1h$24.30 PB 144 039

Overall performance measurements and circumferential surveys of total pressures, velocities and flow angle were obtained in an axial compressor with inlet disturbances covering approximately 25 % of the inlet annulus area. Three configurations were tested to find the principal effects in a single rotor, a complete stage and a multi-stage machine. A two-dimensional linearized theory was developed which includes the effect of losses and leaving angle deviations in the blade rows.

James Forrestal Research Center, Princeton, N. J.
PROJECT SQUID. Semi-annual progress rept. for 1 Oct 57-31 Mar 58 on Contract Nonr-1858(25). 1 Apr 58, 128p. 82 refs. AD-147 921.
Order from LC mi$6.30, ph$19.80 PB 138 556

This study is concerned with the extension of theoretical and experimental methods for the analysis of nonsteady-flow problems. Theoretical investigations of such problems are frequently carried out by means of wave diagrams based on the method of characteristics, and experimental work is based on shock tube techniques. Various cases of boundary conditions in nonsteady flow have been studied. The effect of pressure waves on small regions where the density differs from that in the surrounding gas is also being investigated.

James Forrestal Research Center, Princeton, N. J.
PROJECT SQUID. Semi-annual progress rept. on Contract Nonr-1858(25). 1 Oct 58, 111p. 64 refs.
Order from LC mi$6.00, ph$18.30 PB 143 226

Contents:
Fluid Mechanics: Fundamental investigation of nonsteady flow; Investigation of turbulence; Structure of a detonation wave; Exhaust nozzle impedance to high-frequency longitudinal gas flow oscillations
Transport and Transfer Processes: Thermal conductivity and the viscosity of ammonia and hydrazine; Thermal conductivity of gases and liquids over a range of temperatures and pressures; Atomization, vaporization, and combustion of multicomponent fuel droplets; Dynamic conditions in a spray zone; Statistical properties of two-phase flow; Studies of heat transfer to gases and the mechanism of two phase flow
Chemical Kinetics: Reactions of oxygen atoms; High temperature reactions; Surface-catalyzed atom and free radical reactions;
Combustion Phenomena: Structure and burning mechanism of laminar flat flames; Research on high pressure combustion; Investigation of flame propagation and stability with particular reference to the interaction between flame and flow; Investigation of the basic problems associated with gaseous combustion; Burning velocity, flammability limits, and

ionization in flames; High output combustion; Ionization in detonation waves; Physical properties of various types of flames; Theory of detonations and flame propagation in Gases

Naval Civil Engineering Lab., Port Hueneme, Calif.
WINTERIZATION OF POLAR EQUIPMENT: INTAKE AIR PREHEATING FOR TWO-STROKE-CYCLE ENGINE, by E. J. Beck, Jr. Final rept. 15 Oct 59, 29p. 6 refs. Technical rept. 039.
Order from LC mi$2.70, ph$4.80 PB 143 904

This report deals with the results of the Laboratory's first experiments with supplying heat to the intake air of a two-stroke-cycle diesel engine in order to determine the heat requirement necessary to achieve adequate combustion at low ambient temperatures. Cold chamber tests, in which intake air was electrically heated to simulate engine waste heat input, were conducted at temperatures varying from Port Hueneme normal ambients to -32 F in steps of approximately 32 degrees Fahrenheit. Air preheating was found to markedly improve the operation of a two-stroke-cycle diesel engine. First, heat loss at moderate and low loads must be scrupulously avoided by use of suitable enclosures and intermittent fan operation. Second, relatively large amounts of heat to the intake air would be required to obtain optimum operation, at idle and low loads, but small to moderate amounts, considered to be available in a properly shrouded engine, will allow satisfactory operation. Relatively small amounts of heat to the intake air will be required when the engine is heavily loaded. Specific design approaches are proposed.

New York U. Coll. of Engineering, N. Y.
THERMAL STRESSES IN LONG CYLINDRICAL CASE-BONDED PROPELLANT GRAINS, by Eric E. Ungar and Bernard W. Shaffer. Rept. on Contract NOrd-16640. Sep 58, 31p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 143 604

Equations are presented by means of which one may compute the thermally induced stresses in a bond between a long cylindrical propellant grain and a case surrounding it. The general equations are simplified for assemblies with cases that are elastically stiff and thermally thin compared to the grain. An optimization study shows how the bond stress is affected by the assembly geometry and properties of the materials.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME I. MORPHOLOGY, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 31p. E-1FR049-332; AFOSR-TN-59-103.
Order from LC mi$3.00, ph$6.30 PB 144 009

A survey and classification is made of various types of power sources which might possibly be used in conjunction with propulsion systems for space vehicles. Codification of these types has been systematically developed with the objective in mind of providing a convenient classification by means of which a rapid evaluation of any "new" proposals can be made. A number of possible new power systems and propulsion systems have been brought out. The primary goal in evaluation of all systems is to obtain an unambiguous upper limit to performance, equivalent to that derived for heat engines on the basis of the Carnot cycle. It can be readily observed from the examples given that the basic conservation laws of physics are usually sufficient to settle the question of "feasibility" in regard to any proposal.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME III. DIRECT ELECTRICAL CONVERTERS, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 72p. 15 refs. E-3FR049-332; AFOSR-TN-59-429; AD-214 779.
Order from LC mi$4.50, ph$12.30 PB 143 998

A review of findings.

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME IV. NUCLEAR FISSION REACTORS, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 127p. 17 refs. E4FR049-332; AFOSR-TN-59-428; AD-214 778.
Order from LC mi$6.30, ph$19.80 PB 143 999

A review of findings. (See also PB 143 998)

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES, VOLUME VI. FUSION POWER, by Emil J. Hellund. Rept. on Contract AF 49(638)332. 24 Apr 59, 70p. 3 refs. E-6FR049-332, AFOSR-TN-59-427; AD-214 777.
Order from LC mi$3.90, ph$10.80 PB 144 000

A brief review.
(See also PB 143 999)

Plasmadyne Corp., Santa Ana, Calif.
FUNDAMENTAL INVESTIGATIONS OF ELECTRICAL POWER SOURCES. VOLUME VII. BIBLIOGRAPHIES, by Helen Fife. Rept. on Contract AF 49(638)332. 24 Apr 59, 45p. 379 refs. E-7FR049-332; AFOSR-TR-59-104.
Order from OTS $1.25 PB 161 117

The references listed here are arranged in accordance with the morphology described in our report E-TN088-332 also published under this contract. Briefly, this morphology arranges possible power sources according to whether they are (a) internal (wholly contained within the space vehicle) or external (utilize energy available outside the vehicle), (b) waste (utilize waste products from other functions) or direct storage, and (c) certain detailed categories. The array is presented graphically. The figures contained in brackets are used to form a code which classifies any particular power source. Since there are three levels of classification, each code number consists of these digits: n_1, n_2, n_3.

Machine Parts and Mechanisms

Alloyd Research Corp., Watertown, Mass.
BALL MOTION AND SLIDING FRICTION IN BALL BEARINGS, by A. B. Jones (Fafnir Bearing Co.) Rept. on Contract NObs-72203. [1957] 46p. AD-143 887.
Order from LC mi$3.30, ph$7.80 PB 138 494

A method is derived for determining the motion of the ball and the sliding friction in a high-speed, angular contact ball bearing under thrust load in terms of the inertia effects on the ball and frictional resistances resulting from interfacial slip at the contact area. The solution of eight, simultaneous equations involving double integrals for which closed form solutions cannot be found is required.

George Washington U., Washington, D. C.
A METHOD FOR DETERMINING THE MILITARY WORTH OF SPARE PARTS, by Henry Solomon, Joseph P. Fennell, and Marvin Denicoff. Rept. on Logistics Research Proj., Contract Nonr-761(05). Apr 58, 62p. 1 ref. Serial T-82/58.
Order from LC mi$3.90, ph$10.80 PB 139 364

Manufacturing Equipment and Processes

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.
ENDURANCE TESTS OF MAGNESIUM CASTING ALLOY DOW H CONTAINING VARIOUS GRADES OF TRANSVERSE AND LONGITUDINAL MICRO-SHRINKAGE, by Walter F. Worden. Final rept. on Proj. TED NAM AE 4132, pt. 3. 11 Sep 58, 29p. 6 refs. Rept. no. NAMC-AML-AE-1065.
Order from LC mi$2.70, ph$4.80 PB 138 705

It was established that the fatigue strength of Dow H magnesium casting alloy decreased as the quantity of radiographic defect indications increased, and that longitudinal microshrinkage was less detrimental to fatigue strength than transverse microshrinkage.

Armour Research Foundation, Chicago, Ill.
TIME-TEMPERATURE-TRANSFORMATION DIAGRAMS OF THE TITANIUM SHEET-ROLLING-PROGRAM ALLOYS, by L. E. Tanner. Rept. for 9 June 58-15 June 59 on Department of Defense Titanium Sheet-Rolling Program, Contract AF 18(600)1375. 19 Oct 59, 81p. 19 refs. DMIC rept. no. 46G.
Order from OTS $2.25 PB 151 075

The titanium alloys Ti-2.5Al-16V, Ti-4Al-3Mo-1V, Ti-6Al-4V, and Ti-13V-11Cr-3Al are being evaluated in the Department of Defense Titanium Sheet-Rolling Program. To assist in the determination of optimum heat treatments for these alloys, the kinetics of their transformations were studied for two heat-treatment cycles, and T T T diagrams were constructed. The T T T diagrams resulting from each heat-treatment cycle are shown on the following pages accompanied by a description of the important mechanistic features of the transformations of each alloy.

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsbrugh, Pa.
BUDGET CONTROL AND COST BEHAVIOR, by Andrew C. Stedry. ONR Research memo. no. 60 on Planning and Control of Industrial Operations, Contract Nonr-76001. 28 Feb 58, 44p. 6 refs.
Order from LC mi$3.30, ph$7.80 PB 143 569

This paper represents an investigation into some of the possible reactions which occur in response to a system of budget control. The research described here is a first step in a project whose aim is to establish decision rules which can be utilized in setting up and maintaining an integrated budget control system in an industrial firm. The preliminary work was carried on (1) to define the nature and scope of the problem, (2) to evaluate some of the techniques available for its solution and (3) to point out avenues for future research.

Detroit Arsenal, Center Line, Mich.
ARC WELDING OF ALUMINIZED MILD STEEL, by Donald E. Phelps. 8 Aug 58, 23p. Rept. no. 4225 (Final); AD-202 211.
Order from LC mi$2.70, ph$4.80 PB 143 828

Four different brand electrodes were employed to weld aluminized mild steel sheet 1/16-inch thick. Tests were conducted to determine the suitability of the electrodes, the effect of heat and the corrosion resistance on the welded joint.

Metcut Research Associates, Cincinnati, Ohio.
MANUAL ON THROW-AWAY TOOLING, by D. C. Kaufman, A. Dupuis, and M. Grider. Final technical engineering rept. for 19 June 58-30 June 59 on Contract AF 33(600)37479. 14 July 59, 96p. Wright Aeronautical Serial rept. no. MP. 00-193; AD-226 022.
Order from OTS $2.25 PB 161 276

This Manual describes the benefits that can be derived from a program which replaces brazed carbide cutting tools with throw-away type tooling. The approach used in instituting the throw-away tool conversion program and the steps taken in accomplishing a successful program are described. Graphs, charts, forms and photographs are incorporated to assist in the understandability of the program. Also described in the Manual are cost reduction programs that are directly associated with a throw-away tool conversion program or a natural outgrowth of such a program.

Rock Island Arsenal Lab., Ill.
EVALUATION OF ELECTRICAL-DISCHARGE MACHINING, by F. J. Daasch. Technical rept. 4 June 59, 36p. 5 refs. Rept. no. 59-1516; AD-217 044.
Order from OTS $1.00 PB 161 267

The electrical-discharge method was evaluated for suitability to perform Ordnance manufacturing and production work on the difficult-to-machine metals, machining hardened tool steels, high-speed steel and carbide tool materials. Tests were performed to evaluate the variables such as machining time, surface finish of the workpiece, loss of electrode material and other performance characteristics. Results are included for operations comparable to drilling, tapping and surface removal.

Rodman Lab., Watertown Arsenal, Mass.
MECHANICAL PROPERTIES AND PROCESSING TECHNIQUES FOR HIGH STRENGTH STEEL CASTINGS, by K. D. Holmes, J. Zotos and P. J. Ahearn. Apr 59, 23p. 11 refs. Rept. no. RPL 10/19; AD-220 591
Order from LC mi$2.70, ph$4.80 PB 143 625

Arc furnace and induction melted low-alloy steels were cast into test coupons and shaped castings, heat treated to high strength levels, and physically tested. The arc furnace cast steels exhibited mechanical properties superior to those of induction melted steels, at a strength level of 225,000 psi.

Rodman Lab., Watertown Arsenal, Mass.
PARTICLE COATING IN INVESTMENT CASTING MOLD MANUFACTURE UTILIZING SOLID FLUIDIZATION, by Francis Quigley and Eugene Deluca. Feb 59, 11p. 5 refs. Memo. rept. no. RPL-13/7.
Order from OTS $0.50 PB 161 098

The process of gas-solid fluidization was applied in the development of an improved technique for the application of particle coatings in the manufacture of investment casting molds. A unit was designed and built to accomplish fluidization of solid particle beds. Particle coating was effected by immersion of prewetted forms into the bed in its fluidized state.

Selskapet for Industriell og Teknisk Forskning ved Norges Tekniske Høgskole (Norway).
DISTRIBUTION OF HEAT AROUND FINITE MOVING SOURCES. Final technical rept. for 1 July 58-30 July 59 on Contract DA 91-508-EUC-378. 10 Sep 59, 59p. 28 refs.
Order from LC mi$3.60, ph$9.30 PB 143 836

Calorimetric measurements have been made of the net heat transferred to the work-piece in welding with the argon-arc, metal-arc, and SIGMA processes. A method is suggested for presenting the distribution of temperature around a point source in one diagram valid for all materials and operating condition. Measured temperatures outside the weld pool are in fair agreement with theory at a sufficient distance from the weld, but deviations are observed in regions closer to the weld. A procedure is outlined for the assessment of average bath temperatures from the measured temperature distribution in the parent-plate material. Exploratory measurements of liquid weld metal temperatures indicate temperatures in the order of 2000°C and 1500°C in the welding of steel and of aluminum, respectively.

Springfield Armory, Mass.
RECLAMATION OF DIAMONDS FROM MACHINE WIPING CLOTHS, by K. A. Jorczak. 23 Mar 59, 11p. SA-TR20-7003.
Order from OTS $0.50 PB 161 121

The most suitable method developed is based on washing the diamond-bearing cloths with a synthetic detergent in a washing machine which is fitted with a wire mesh screen over a false bottom. The recovered residue is treated by the flotation method similar to that used for diamond reclamation from grinding wheels and segregated swarf or sludge.

Transport, Traction and Hoist Facilities

California U., Los Angeles.
TECHNICAL STUDIES IN CARGO HANDLING. V. EFFECT OF COMMUNICATION ON A N-STAGE SHUTTLE PROCESS, by Maurice Pollack. Rept. on Contract Nonr-233(07). May 58, 28p. 5 refs. Dept. of Engineering rept. 58-43; AD-218 980.
Order from LC mi$2.70, ph$4.80 PB 138 840

By means of a simple model, it is shown that the effect of communication on a shuttle process is small. The link-node model of cargo handling developed by R. R. O'Neill is found to be a good representation of actual systems. The "effectiveness" of a shuttle process as predicted by this link-node model is well correlated with actual field data values of "balance allowance" given by R. Herbert. It is also possible to obtain the values of coefficient of variation which correspond to the balance allowances given by R. Herbert.

Goodrich, B. F., Aviation Products, Troy, N. Y.
EVALUATION OF B. F. GOODRICH 450°F AMBIENT TEMPERATURE BRAKE, by Carlos F. Afanador Rept. for May 57-Dec 58 on Contract AF 33(600)35046. June 59, 36p. WADC Technical rept. 59-198.
Order from OTS $1.00 PB 161 143

The purpose of this contract was to evaluate a B. F. Goodrich capsule-actuated disk brake operating from an ambient temperature of 450°F, and to determine the effects of forced air cooling. The assembly used in the test was designed, manufactured, and laboratory tested at the B. F. Goodrich Wheel and Brake Plant, Troy, Ohio. The brake successfully passed the required laboratory testing. Operation at the required ambient temperature was confirmed by the data presented herein. Further testing will be conducted at the WADC laboratory.

Southwest Research Inst., San Antonio, Tex.
INDUCTION SYSTEM ICING IN ORDNANCE AUTOMOTIVE VEHICLES: A LITERATURE SURVEY AND ANALYSIS. Final rept. on Contract DA 23-072-ORD-836, T.O. 4. Feb. 56, 78p. 122 refs.
Order from OTS $2.00 PB 131 844

Analysis of the icing problem in the induction system of Ordnance engines may be divided into three separate discussions of the water sources from which the ice is formed. The format of this report consists of three main headings covering the formation of ice caused by condensation and freezing of atmospheric water vapor, water in the fuel, and induction of entrained atmospheric solids, such as snow, in the charge air. Following these analyses, consideration is given to methods of indicating the presence of ice as well as anti-icer and deicer systems. A summary with conclusions also is presented regarding the overall induction system icing problem in Ordnance vehicles.

MATERIALS

Clapp, William F., Labs., Inc., Duxbury, Mass.
INVESTIGATION OF GLASS CLOTH OVERLAYS ON PLYWOOD AS PROTECTION AGAINST MARINE BORER ACTIVITY. Final rept. on Contract NObs-72139. 10 Jan 57, 8p. Rept. no. 10261; ITL no. 2007-J; AD-139 699.
Order from OTS $0.50 PB 151 998

The exposure of plywood panels covered with overlays of duck, duck with silica added, fiberglas cloth, as well as duck with less than normal resin content in the overlay to marine borer activity at Kure Beach, North Carolina for 39 months and at Daytona Beach, Florida, for 51 months revealed that no borers were able to penetrate the overlays with the exception of those overlays with reduced resin content. Marine fungi were found to be active in those overlays containing natural fibers. Paint adherence and effectiveness was relatively poor on all panels in the series. Adherence of the duck overlays to the wood, with and without silica added, was better than those with fiberglas cloth after the first 24 months exposure.

Danielson Mfg. Co., Conn.
DEVELOPMENT OF MOLDED NYLON SAMPLES, by William McKinlay. Final rept. for 1953-1958 on Contract DA 18-064-404-cml-22. 15 June 58, 108p.
Order from LC mi$5.70, ph$16.80 PB 143 333

The contract was successfully completed after considerable experimentation and a number of changes to the designs originally envisaged. The final approved samplers were molded of two types of nylon, "Zytel 101" supplied by E. I. duPont de Nemours & Company, and "Spencer 401" supplied by Spencer Chemical Company. Figures 3 and 4 show the designs finally adopted, figures 5, 6, 7 and 8 show photographs of the samples, and brochures 1 and 2 of Appendix B give the physical properties of the two nylons used.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
EVALUATION OF SOME METHODS OF NICKEL FERRITE FORMATION; EFFECT OF IRON OXIDE PARTICLE SIZE ON NICKEL FERRITE FORMATION; CURRENT PROBLEMS IN THE PRODUCTION OF MAGNETIC CERAMICS, by George Economos. Rept. on Contract Nonr-1841(10). Nov 58, 49p. 24 refs. Technical rept. nos. 129, 130, 131.
Order from LC mi$3.30, ph$7.80 PB 143 601

The extent of nickel ferrite formation, as affected by four preparatory techniques, was investigated by determining the magnetic moment of the reacted powder with a vibrating-coil magnetometer. The oxide, carbonate, hydroxide and oxalate methods were used. At low temperatures the hydroxide and oxalate techniques were found to give the greatest yield of ferrospinel. The hydroxide method yields a magnetic material by precipitation. Weight-loss measurements are correlated to the magnetic data. Five iron oxides of increasing particle-size distribution, mixed with nickel oxide of a constant-size range, were heated at various temperatures and time intervals. The extent of nickel ferrite formation, as influenced by particle size distribution of the iron oxide constituent, was measured with a compensating-coil magnetometer. Using the Jander relationship for this type of reaction, activation energies ranging from 54 to 70 kcal were computed for increasing particle size. These results are examined and compared with current procedures for the production of ferrite powders. Reproducibility of the electrical and magnetic properties while adhering to mechanical tolerances is still the main difficulty in quantity production of magnetic ceramics. This problem is discussed from a developmental viewpoint with suggestions for improving present methods.

Vitro Labs., West Orange, N. J.
INVESTIGATION OF THE HIGH INTENSITY ARC TECHNIQUE FOR MATERIALS TESTING, by Charles Sheer, C. Dudley Fitz and others. Rept. for Apr 57 to Mar 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3669. Nov 58, 109p. 20 refs. WADC Technical rept. 58-142; AD-205 364.
Order from OTS $2.50 PB 161 265

Basic studies performed during the second year of a two-year program to evaluate the adaptability of the high intensity arc flame as a testing medium are described. A more stable and controllable configuration of arc operation, featuring a triple cathode, was developed. The pulse method of measuring tail flame velocity was improved, and the range of measurements extended by using a more powerful electronic pulsing device. Several flow visualization techniques were utilized to determine flow patterns of the arc plasma in the vicinity of solid objects. Direct and schlieren photography showed an abnormally thick boundry layer for the flow of plasma near the models; a possible explanation is offered. Finally, attempts were made to measure thermal diffusivities of copper, graphite, molybdenum, and tungsten by inserting appropriate specimens in the flame. Results indicate that the technique of measurement requires further development to obtain reliable measurements using a plasma flame.

Ceramics and Refractories

Minerals Research Lab., U. of California, Berkeley.
INTERNAL STRESSES IN MODEL CERAMIC SYSTEMS, by Richard M. Fulrath. Technical progress rept. no. 1 on Contract AF 49(638)4. 20 Mar 58, 31p. 1 ref. Series no. 119, issue no. 1.
Order from LC mi$3.00, ph$6.30 PB 138 927

Model ceramic systems of crystals and glass fabricated by vacuum hot compaction have been used to study methods of detection of internal stress on the crystalline phase. Effects of the volume fraction of the glass, compaction temperature and time, and crystal particle size in modifying induced internal stress are presented. These effects together with x-ray diffraction and wetting studies indicate that internal stress development is closely connected to wetting of the crystal by the glass and formation of a second crystalline phase.

National Bureau of Standards, Washington, D. C.
FACTORS CONTROLLING RESISTANCE TO DEFORMATION AND MECHANICAL FAILURE IN POLYCRYSTALLINE (GLASS-FREE) CERAMICS, by John B. Wachtman, Jr., Wayne E. Tefft and others. Rept. for 1 July 57-15 Dec 58 on Solid State Research and Properties of Matter, Contract AF 33(616)56-4. May 59, 83p. 35 refs. WADC Technical rept. 59-278.
Order from OTS $2.25 PB 161 112

The elastic moduli and internal friction of several refractory oxide materials were studied. The six elastic constants of sapphire were measured with particular care and the results were found to differ from previously accepted values for four of these constants. Young's modulus for single crystal sapphire was found to decrease linearly with increasing temperature above 100°C. As the temperature was decreased below 100°C, Young's modulus first rose above the extrapolated high temperature straight line and then tended to become constant. The internal friction of single crystal sapphire was found to vary from 5×10^{-5} to 3×10^{-6} at room temperature. Annealing below 500°C decreased the value in a specimen with initially high damping. An internal friction peak was found in polycrystalline alumina with 15% lanthanum oxide additive. Young's modulus of uranium dioxide was measured as a function of temperature. Two internal friction peaks were found in polycrystalline zirconium oxide stabilized with 5% calcium oxide. These results are discussed.

Rodman Lab., Watertown Arsenal, Mass.
PROPOSED BASIS FOR TESTS OF CEMENTED CARBIDES, by William O. Woods. May 59, 16p. 11 refs. Rept. no. RPL-43/2.
Order from OTS $0.50 PB 161 269

Based on data compiled from information obtained from industrial producers and other carbide investigators, an examination was made of the hypothesis that a linear relation exists between hardness and strength of cemented carbide materials. The study incorporates mathematical and graphic representations of the precepts involved in the investigation. Data reported by Kieffer and Hotop were chosen as representative for the extended examination.

Utah U. Coll. of Engineering, Salt Lake City.
THE IRREVERSIBLE COMPRESSIBILITY OF SILICA GLASS, by William B. Gogarty. Technical rept. no. 4 on Contract Nonr-1288(02). May 58, 32p. 7 refs, AD-161 491.
Order from LC mi$3.00, ph$6.30 PB 138 817

The compressibility of silica glass wafers was measured by means of density changes in small specimens.

Fuels, Lubricants, and Hydraulic Fluids

Atlantic Research Corp., Alexandria, Va.
INVESTIGATION TO DETERMINE BUILDUP OF A STATIC ELECTRIC FIELD CHARGE IN A ROLLING FLUID TRANSPORTER. Final rept., Phase 2 on Contract DA 44-177-tc-461. 15 June 59, 38p.
Order from LC mi$3.00, ph$6.30 PB 143 323

This is the final report of the Phase II work on an "Investigation to Determine Buildup of Static Electric Field Charge in a Rolling Fluid Transporter," and is a summary of the entire work of Phase II. The purpose of this program was to improve understanding of the phenomena involved in the generation and discharge of static electricity in the transporter. Results of tests made with JP-4 in the transporter simulating normal cold weather operating conditions gave positive evidence of static discharges. In the range tested the rate and intensity of discharges appeared to increase with increasing transporter speed and with decreasing transporter temperature, especially below 35°F. Rough roads and sharp turns also appeared to increase the rate and intensity of discharges. These results generally confirm those of Phase I of this work and, in addition, establish the importance of fuel temperature. In order to assess the relative hazards of the transporter and a standard fuel truck, an Air Force F-6 tank truck was tested for static discharges during cold weather. Static discharges were detected in a truck filled 40 per cent with JP-4 at 37°F and were especially intense when operation was over rough terrain. A conclusion that the relative hazards of the two devices are the same under similar operating conditions cannot be considered firm on the basis of this work. However, continued explosion-free operation of transporters with an explosive mixture in the vapor space would help support such a conclusion.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
DEVELOPMENT OF AN OPERATIONAL PRESERVATIVE HYDRAULIC BRAKE FLUID, by Charles B. Jordan. 26 Aug 59, 21p. 19 refs. Rept. no. CCL-81.
Order from OTS $0.75 PB 161 096

The object of this study was to develop a combination preservative and operational fluid for use in automotive hydraulic brake systems and components. Brake fluid components were selected which were known to have good preservative properties. Combinations of these components were subjected to tests outlined in Specification VV-H-910. The more promising fluids were stored with brake parts in warehouse and simulated vehicle storage. From the preliminary results received in the storage tests, a fluid combination was chosen. Different inhibitor combinations were tried until maximum corrosion protection and stability could be obtained. The fluid outlined in this report meets all requirements of Specification VV-H-910 except the sub-zero requirements. It is satisfactory with natur and SBR synthetic rubber cups. It tolerates up to 5% moisture. It performs satisfactorily in the stroking machine at 158°F. It has satisfactorily passed storage tests up to 30 months. A proposed specification has been written for the fluid.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
QUANTITATIVE DETERMINATION OF ETHYLENE GLYCOL IN COOLANT MEDIA BY INFRARED ANALYSIS, by Jules B. Counts. 5 Aug 59, 13p. 3 refs. CCL #79, AD-225 394.
Order from LC mi$2.40, ph$3.30 PB 143 328

This report describes the application of infrared analysis to the quantitative determination of ethylene glycol in a mixture of glycols. The method utilizes the base line technique in conjunction with a working curve. Two unique analytical features of the method are the saturation of the glycol mixtures with sodium chloride to prevent attack of the rock salt cell window by the small amounts of water normally present in glycol mixtures, and the use of dimethylformamide as a transparent solvent for the glycols. The dissolved ethylene glycol is treated as a minor constituent of the mixture and the absorp tion recorded differentially. A correction is made for the presence of diethylene glycol. It is recommended that this method be used for the analysis of ethylene glycol in glycol mixtures, and that the method be studied further for possible application to other constituents of coolant media.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF T34 PROPELLANT: AN IMPROVED NITROGUANIDINE COMPOSITION, by Russell L. Trask and David J. Zauder. July 59, 40p. 7 refs. Technical rept. 2629.
Order from LC mi$3.00, ph$6.30 PB 143 285

A new nitroguanidine propellant which is ballistically and physically superior to standard M15 propellant and requires 50% less final mixing time has been developed. The new propellant has been found to have better ballistic uniformity than M15 over a wide range of test conditions; its temperature and pressure dependence are significantly less; and it produces less flash and is at least as smokeless as M15 propellant.

Frankford Arsenal, Philadelphia, Pa.
SOLID PROPELLANT CHEMICAL STABILITY: A SURVEY, by J. Quinlan. Sep 58, 22p. 55 refs. Technical rept. no. R-1465.
Order from LC mi$2.70, ph$4.80 PB 143 827

A survey has been made of the presently available literature in order to determine the relationship between the chemical stability of solid propellants and the variation in nitroglycerine content and the degree of nitration of the nitrocellulose. The decomposition mechanism of nitrocellulose and the effect of temperature and various additives upon propellant stability are presented. It is noted that the stability varies inversely as the nitroglycerine content and that, as the nitrocellulose nitrogen is increased, there is a tendency toward exponential chemical decomposition. When exudation of nitroglycerine occurs, it is promoted by the presence of diphenylamine, but no conclusion is reached upon the effect of nitrocellulose nitrogen on this phenomenon. The reliability of safe life tests made above 65.5° C is questionable.

Inland Testing Labs., Morton Grove, Ill.
THE BEHAVIOR OF FUELS AND LUBRICANTS IN DYNAMIC TEST EQUIPMENT OPERATING IN THE PRESENCE OF GAMMA RADIATION, by M. E. Krasnow, O. P. Reynolds and O. C. Wolford. Rept. for 31 Mar 58-31 Mar 59 on Chemical Propulsion Subsystems, Contract AF 33(616)3865. 31 Mar 59, 182p. 12 refs. WADC Technical rept. 58-264, Pt. 2, Preprint Copy.
Order from OTS $3.00 PB 161 127

This report summarizes work conducted on a program designed to evaluate fuels, lubricants, and hydraulic fluids for use in a nuclear-powered aircraft. During the performance period, April 1958 to March 1959, 52 fuels, 44 lubricating oils, 4 greases, 4 dry film lubricants, and 1 hydraulic fluid were investigated. The most promising fuels and lubricants are listed in the accompanying tables. These materials were selected on the basis of performance in dynamic test machinery operated in a radiation environment and predict useful performance characteristics of lubricants up to doses of 10^{10} ergs/gmC and of fuels up to 10^{9} ergs/gmC. (See also PB 151 701)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE THERMAL DECOMPOSITION OF AMMONIUM NITRATE, by Russell N. Doescher. Rept. on Basic Research on Rocket Propellants, Contract W04-200-ORD-1482. 15 Mar 50, 12p. 28 refs. Progress rept. no. 9-43.
Order from LC mi$2.40, ph$3.30 PB 144 095

Interest has recently been stimulated in the use of ammonium nitrate in solid propellants for rockets, one of the principal factors being the recognition that it is possible to prepare smokeless mixtures with this compound. The burning of solid propellant charges containing ammonium nitrate is understood only incompletely, but it is believed that the thermal decomposition of the ammonium nitrate is an important step

in the process. Accordingly a literature and experimental study of this decomposition was undertaken. The initial phase of the study has been completed, and the results are given in the present report. The contribution represented here consists of the development of a simple, rapid, and easily applied method of measuring the catalytic activity of a given solid substance in the thermal decomposition of ammonium nitrate and the partial coordination of pertinent knowledge presently available.

Ordnance Fuels and Lubricants Research Lab., Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF A THERMAL-OXIDATION STABILITY TEST FOR GEAR LUBRICANTS, by Nelson T. Meckel. Rept. on Contract DA 23-072-ORD-1144. June 58, 128p. 1 ref.
Order from LC mi$6.30, ph$19.80 PB 138 780

An apparatus and procedure to determine thermal-oxidation stability of gear lubricants were developed. The objective of this work was to devise a thermal-oxidation test technique which would correlate with military field test results. A refined laboratory version was designed and a final test procedure was developed. The apparatus, procedure and test results are presented in this report.

Princeton U., N. J.
FURTHER STUDIES ON THE LIGHT SCATTERING TECHNIQUE FOR DETERMINATION OF SIZE DISTRIBUTIONS IN BURNING SPRAYS, I, by R. A. Dobbins. Technical rept. on Contract AF 18(600)1527. 10 Apr 59, 37p. 15 refs. Aeronautical Engineering Lab. rept. no. 463; AFOSR TN-59-700; AD-220 496.
Order from LC mi$3.00, ph$6.30 PB 143 022

Rocketdyne, Canoga Park, Calif.
EFFECTS OF GAS MOTION ON HETEROGENEOUS COMBUSTION; NATURAL CONVECTION, STEADY FORCED CONVECTION, STANDING ACOUSTIC WAVES, AND SHOCK WAVES, by William T. Webber. Final summary rept. on Contract AF 33(616)3556. Apr 59, 92p. 26 refs. WADC Technical rept. 59-50.
Order from OTS $2.25 PB 161 128

Two experimental techniques have been used to determine the effects of gas motion upon the combustion of liquid fuels under extremes of conditions resembling those found in liquid rocket combustion chambers. In the first technique methanol was burned as it flowed down a vertical quartz fibre mounted in a pressure vessel containing pure oxygen at pressures from 1.0 to 10.2 atmospheres. The combustion rate was determined under conditions of natural convection, with steady forced flow transverse to the fibre; and with the fibre held at the velocity loop of a very strong standing acoustic field. The application of conventional heat and mass transfer correlations for cylinders give theoretical values for combustion rate which are in fairly close agreement with the experimentally observed data. Reynolds number (based on fuel element diameter) was varied from 340.0 to 5300.0. Grashof number was varied from 1.3 million to 340.0 million. In the acoustic field the Reynolds number was derived from the mean gas particle velocity. The second technique was to burn sprays of liquid fuel in an oxygen atmosphere in the channel of a shock tube through which a pressure pulse was passed. Here the pressure, velocity, and temperature perturbations of the wave affect the combustion rate at the location of, and in the wake of the wave, and thus can act to sustain or augment the wave to the point where it resembles a detonation. Some experiments were conducted to determine which combinations of droplet size, initiating pulse amplitude, pulse duration, extent of combustion completed before introduction of the pulse, etc., cause the wave to grow to detonation strength, and which allow it to decay. Other experiments were conducted to quantitatively infer combustion rates as functions of wave strength, by measuring pressure histories at several positions along the tube. In these experiments, Reynolds numbers per centimeter ranged from about 150,000 to 1,500,000. Combustion rates increase with Reynolds number at about the proper slope to agree with classical correlations for heat and mass transfer up to Reynolds numbers per centimeter of about 450,000. Beyond this point there appears to be a sudden increase in rate.

Leather and Textiles

Fabric Research Labs., Inc., Dedham, Mass.
METHODS OF WITHIN-SECTION BLEND ANALYSIS, by Myron J. Coplan and William G. Klein. Technical rept. no. 6 on Contract Nonr-1422(00). 1 Dec 58, 31p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 143 610

Statistical implications of the Index of Blend Irregularity have been elaborated, with consequent improved utility of this measure. A more complete characterization of within-section blend distribution is now possible by two new techniques developed. Some new light is shed on the characteristics of fiber clustering and blend irregularity within the sections of woolen wool-nylon yarn.

Naval Supply Research and Development Facility, Bayonne, N. J.
DEVELOPMENT OF SOLUTION DYED RAYON FABRICS FOR FLIGHT DECK IDENTIFICATION CLOTHING, by Jack Naimer. 15 June 59, 13p. 3 refs. Research and Development rept. no. 31.
Order fromLC mi$2.40, ph$3.30 PB 143 504

Solution dyed rayon fabrics in six colors were developed for use in winter identification garments worn by flight deck personnel on aircraft carriers. The materials were evaluated in the laboratory for breaking strength (wet and dry), tear strength, cumulative shrinkage, fabrication properties and colorfastness. A cotton-back rayon satin was found to be more suitable for the intended end use than a similar all-rayon construction. Original report contains dyed specimens in color which will not reproduce.

Quartermaster Research and Engineering Center, Natick, Mass.
AN EVALUATION OF NEW FIBER BLENDS IN ARMY SUMMER UNIFORM FABRICS, by C. J. Monego and S. J. Kennedy. May 59, 72p. 16 refs. Textile Series rept. no. 108.
Order from LC mi$4.50, ph$12.30 PB 143 737

This report presents the results of a detailed laboratory and field study on nine tropical-type blended fabrics which were developed for this test through close cooperation between fiber producers and fabric manufacturers. The development of each fabric was based on the fabric manufacturer's previous experience with that particular blend on the civilian market, and only those blends which had achieved a marked consumer preference were considered. The results of this study show that the 60/40 polyester/wool blend performed well in laboratory tests and ranked higher than the other fabrics in field tests.

Textile Research Inst., Princeton, N. J.
EFFECTS OF CRIMP AND CROSS-SECTIONAL AREA ON THE MECHANICAL PROPERTIES OF WOOL FIBERS, by Joseph H. Dusenbury and James H. Wakelin. Technical rept. no. 17 on Contracts Nonr-090(00) and Nonr-090(01). 29 Apr 58, 45p. 22 refs.
Order from LC mi$3.30, ph$7.80 PB 138 584

Force-extension data for a large number of wool fibers of various types have been analyzed in detail by statistical methods in order to determine the effects of fiber crimp and cross-sectional area on mechanical behavior. The methods of crimp evaluation used indicate that (1) within a group of fibers taken from the same Rambouillet sheep the crimp level increases with increasing fiber diameter, and (2) among fibers taken from sheep of different breeds the crimp level decreases with increasing fiber diameter. It is also observed that the rupture properties, breaking stress and breaking extension, generally increase with increasing fiber diameter.

Paints and Finishes

Material Lab., New York Naval Shipyard, Brooklyn.
THE MATERIAL LABORATORY ICE SHEAR ADHESION APPARATUS AND TEST METHOD, by H. Lacks and M. Quatinetz. Final rept. 9 Aug 55, 17p 3 refs. Lab. Proj. 5284-3; AD-76 789.
Order from LC mi$2.40, ph$3.30 PB 144 325

The Material Laboratory is engaged in the development of ice-phobic paints for shipboard use, that is, paints to which ice will have little or no adhesion. This report describes the ice shear adhesion apparatus and test method employed in the project to measure the adhesion of ice to a surface and reviews the variables involved in such measurements. It also lists the other items of equipment used in the work.

Naval Civil Engineering Lab., Port Hueneme, Calif.
CATALOG OF INFRARED SPECTRA OF PAINTS AND DRYING OILS, by J. B. Crilly and R. J. McGowan. Interim rept. 7 Aug 59, 36p. 9 refs. Technical Compilation C-001; AD-214 883.
Order from LC mi$3.00, ph$6.30 PB 143 287

This report presents a catalog of infrared spectra of paint vehicles conforming to selected specifications and of drying oils used in paint formulations. It is intended to be used as a reference for inspection and identification of nonvolatile vehicles of paints. The spectra of 32 drying oils commercially treated in a variety of ways are presented. The spectra of 18 specification paint vehicles are also presented. Two samples of paint were found not to conform to the expected pattern. One of these has been identified.

Rubber and Elastomers

Frick Chemical Lab., Princeton U., N. J.
THE OXIDATIVE CROSS-LINKING REACTION IN POLYDIENE VULCANIZATES, by A. V. Tobolsky and A. Mercurio (Doctoral thesis). Rept. on Contract Nonr-1858(07). 15 Dec 58, 7p. 5 refs. ONR Technical rept. RLT-26.
Order from LC mi$1.80, ph$1.80 PB 143 854

Intermittent and continuous stress relaxation methods have been utilized to follow the oxidative degradation of vulcanizates of natural rubber and of synthetically prepared polybutadienes. Vulcanizates were prepared by exposing samples to high energy electrons. For natural rubber only oxidative scission reactions were detected, while emulsion polymerized polybutadiene and all cis 1, 4 polybutadiene exhibited both oxidative scission and oxidative cross-linking. With sulfur vulcanizates of the above there is superposed on the oxidation reactions a continued vulcanization caused by remaining curing agent.

Frick Chemical Lab., Princeton U., N. J.
OXIDATIVE STRESS RELAXATION OF RADIATION CROSSLINKED NATURAL RUBBER, by A. V. Tobolsky and A. Mercurio (Doctor thesis). Rept. on Contract Nonr-1858(07). 1 Dec 58, 14p. 16 refs. Technical rept. RLT-25; AD-207 292.
Order from LC mi$2.40, ph$3.30 PB 143 855

Evidence is presented which shows that oxidative scission at elevated temperatures is independent of the degree of cross-linking in radiation cross-linked natural rubber as studied by stress relaxation. The rate of scission in these vulcanizates is the same within 50 per cent as the rate of scission determined for unvulcanized rubber. These results demonstrate that scission in the vulcanizates occurs randomly along polyisoprene chains, not specifically at the cross-linked sites.

Massachusetts U., Amherst.
ON THE CONFIGURATION OF FLUOROCARBON-AMIDENE ELASTOMERS. II. THE GEL STRUCTURE, by Richard S. Stein. Rept. on Contract Nonr-2151(00). 2 Oct 58, 11p. 1 ref; AD-217 767.
Order from LC mi$2.40, ph$3.30 PB 143 227

(See also PB 143 228)

Rock Island Arsenal Lab., Ill.
AGING OF UNSTRESSED ELASTOMERIC VULCANIZATES DURING OUTDOOR AND CONTROLLED HUMIDITY EXPOSURES, by E. W. Bergstrom. 9 July 58, 21p. 8 refs. Rept. no. 58-1808.
Order from LC mi$2.70, ph$4.80 PB 138 762

This report covers (1) the results of a seven year humidity aging program using vulcanizates based on copolymers of butadiene/styrene, isobutylene/isoprene, butadiene/acrylonitrile, and the homopolymer of chloroprene as well as inhibited (antioxidant) and uninhibited natural rubber vulcanizates and (2) the results of a six year outdoor aging program on all vulcanizates mentioned above except the uninhibited natural rubber. The effect of humidity on the physical properties of the vulcanizates was determined after they had been exposed indoors, unstressed, to relative humidity concentrations of 0, 50, 100 and a cycle of 0 and 100% for periods of one, three, five and seven years. The effect of outdoor weathering was determined after the vulcanizates had been aged outdoors, unstressed, for periods of one, two, three, four, five and six years. A statistical analysis of the data obtained from the humidity aging phase of this investigation showed that relative humidity was not a significant factor in the aging of the characteristics of the various vulcanizate types studied, which was to be expected. A comparison of the physical properties of the vulcanizates aged indoors with those aged outdoors showed that all the vulcanizates resisted aging less outdoors than indoors; the hevea and butadiene/styrene based vulcanizates showed the greatest differences in amount of deterioration (outdoor vs indoor) while the isobutylene/isoprene based vulcanizate showed the least difference.

MATHEMATICS

Air Force Cambridge Research Center, Bedford, Mass.
TABLES AND SCHEMES FOR EVALUATING FOURIER COEFFICIENTS OF PERIODIC FUNCTIONS, by Kurt H. Haase. June 59, 93p. AFCRC-TR-59-154; AD-216 367.
Order from LC mi$5.40, ph$15.30 PB 143 968

This volume contains the tables and schemes required to solve practical problems by a new procedure for analyzing periodic functions, described in A Method for Numerical Evaluation of the Coefficients of Fourier Series, by Kurt H. Haase, AFCRC-TR-59-153. Tabulations are of the function

$$\sin\frac{\pi}{N/r}\cdot\frac{k}{r},$$

where k, r, and N are integers, and of the function

$$C_n(m)=\left[\frac{\sin \pi n/2n}{m/2n}\right]^2$$

where m is the sequence of positive integers and n is a parameter integer. The schemes are closely related to the particular method but the tables may also have use in other applications.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
TRANSLATION INVARIANT FUNCTION ALGEBRAS ON ABELIAN GROUPS, by Karel Deleeuw and Hazelton Mirkil. Technical note no. 5 on Contract AF 49(638)294. 26 Aug 59, 47p. 10 refs. AFOSR-TN-59-659; AD-225 363.
Order from LC mi$3.30, ph$7.80 PB 143 524

Results are established concerning translation invariant uniformly closed subalgebras of the algebra $C_0(X)$ of continuous functions, zero at infinity, on a locally compact abelian group X.

California U., Berkeley.
FREE BOUNDARY PROBLEMS FOR PARABOLIC EQUATIONS, by Avner Friedman. Technical rept. no. 28 on Contract Nonr-222(37). Oct 58, 72p. 29 refs.
Order from LC mi$4.50, ph$12.30 PB 142 861

In this paper the method of Rubinstein is refined and applied to solve Stefan problems for all future times and the problems of evaporation and condensation of drops for small intervals of time.

California U., Berkeley.
A STRONG MAXIMUM PRINCIPLE FOR WEAKLY L-SUBHARMONIC FUNCTIONS, by Walter Littman. Technical rept. no. 1 on Contract Nonr-222(62). Aug 58, 19p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 142 818

Carnegie Inst. of Tech., Pittsburgh, Pa.
NOTES ON THE ANALYSIS OF VARIANCE OF LOGARITHMS OF VARIANCES, by Robert E. Odeh and Edwin G. Olds. Rept. on Research on Transformations in the Analysis of Variance, Contract AF 33(616)3878. Mar 59, 53p. 15 refs. WADC Technical note 59-82; AD-211 917.
Order from OTS $1.50 PB 161 108

One of the assumptions needed in the Analysis of Variance is equality of within-cell variances. Often the validity of this assumption is investigated by the use of Bartlett's modification of the Neyman-Pearson L_1 test. The present report is concerned with the investigation of an alternative test which seems to have some more desirable properties. An example of the use of the proposed test is given. Some analytical results are derived. Tables of the approximate probability for the Type I error are given for the case when the sampled distribution is normal.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ON POSITIVE REAL FUNCTIONS, by Jack Leonard Goldberg, Doctoral thesis. Interim technical rept. no. 14 on Contract DA 11-022-ORD-1983. 27 Mar 59, 59p. 10 refs.
Order from LC mi$3.60, ph$9.30 PB 143 114

Functions which map the right half-plane into itself and take reals into reals - the so-called Positive Real functions - are studied by considering iterations of a transformation of P. Richards (A special class of functions with positive real part in a half-plane, Duke Mathematical Journal, Vol. 14, (1947), p. 779) which takes Positive Real functions into Positive Real functions.

Laboratory of Statistical Research, U. of Washington, Seattle.
UNBIASED ESTIMATION: FUNCTIONS OF LOCATION AND SCALE PARAMETERS, by Robert F. Tate. Technical rept. no. 31 on Contract Nonr-477(11). 16 Oct 58, 44p. 16 refs.
Order from LC mi$3.30, ph$7.80 PB 143 794

Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAHN DECOMPOSITIONS AND HYPOTHESIS TESTS, by I. S. Reed, E. J. Kelly and D. H. Lyons. Rept. on Contract AF 19(122)458. 4 Mar 57, 7p. 2 refs. Technical rept. no. 152. AD-137 718.
Order from LC mi$1.80, ph$1.80 PB 144 045

The relation between hypothesis tests and Hahn decompositions of measure spaces is briefly discussed. Several theorems concerning Hahn sets are presented, making possible the direct application of this relation to denumerably infinite dimensional spaces.

Midwest Research Inst. [Kansas City, Mo.]
EXPANSION OF THE GAUSSIAN HYPERGEOMETRIC FUNCTION IN SERIES OF FUNCTIONS OF THE SAME KIND, by Richard L. Coleman and Yudell L. Luke. Rept. on Contract AF 49(638)66. 15 Aug 59, 16p. 7 refs. AFOSR Technical note 59-734; AD-225 713.
Order from LC mi$2.40, ph$3.30 PB 143 772

An expansion of the hypergeometric function ${}_2F_1(a,b;c;z)$ in series of hypergeometric functions with changed argument is derived. For special values of the parameters the expansion simplifies considerably and is especially advantageous due to the change in argument which yields more rapidly converging series. Known Chebyshev type expansions for the logarithm and arc tangent functions are derived. The Gauss transformation for the complete elliptic integral of the first kind is the special case $a = b = \frac{1}{2}$, $c = 1$. Finally, a rapidly converging expansion of the complete elliptic integral of the first kind is derived for modulus near 1.

Stanford Electronics Lab., Stanford U., Calif.
A DISCUSSION OF SAMPLING THEOREMS, by D. A. Linden. Rept. on Contract Nonr-225(24). 14 Nov 58, 30p. 8 refs. Technical rept. no. 1551-1.
Order from LC mi$2.70, ph$4.80 PB 143 487

The convolution theorem of Fourier analysis is a convenient tool for the derivation of a number of sampling theorems. This approach has been used by several authors to discuss first-order sampling of functions whose spectrum is limited to a region including the origin ("low-pass" functions). The present paper extends this technique to several other cases: second-order sampling of low-pass and band-pass functions, quadrature and Hilbert-transform sampling, sampling of periodic functions, and simultaneous sampling of a function and of one or more of its derivatives.

Stanford U., Calif.
AN EXAMPLE OF FIDUCIAL INFERENCE, by Charles Stein. Technical rept. no. 21 on Contract Nonr-225(21). 17 Oct 58, 7p. 7 refs.
Order from LC mi$1.80, ph$1.80 PB 143 337

Virginia Agricultural Experiment Station, Blacksburg.
ON THE ANALYSIS OF PAIRED RANKED OBSERVATIONS, by Leo Lynch and John E. Freund. Technical rept. no. 32 on Contract DA 36-034-ORD-1527. Aug 57, 80p. 18 refs. AD-140 412
Order from LC mi$4.50, ph$12.30 PB 138 179

An extension is considered of the problem of deciding in the case of 2 k-variate populations whether several samples should be regarded as coming from the same population. The first approach is made by means of discriminant analysis. The ranked sample points are projected onto a vector giving maximum discrimination between the 2 samples, and the sample points are then reranked along this vector. The problem is reduced to a one-dimensional situation, but the standard one-dimensional nonparametric tests cannot be used so that this approach is unsatisfactory. The other approach is based on the Euclidean (or more general) distance between the centroids of the ranked samples. Several methods are suggested for constructing approximate tests of significance on the basis of such a distance.

Virginia Agricultural Experiment Station, Blacksburg.
TWO-WAY RANK SUM TESTS FOR VARIANCES, by John E. Freund and Abdur R. Ansari. Technical rept. no. 34 on Contract DA 36-034-ORD-1527. Aug 57, 13p. 1 ref. AD-140 410.
Order from LC mi$2.40, ph$3.30 PB 138 178

Two rank-sum procedures are developed for testing the null hypothesis that 2 samples come from populations with identical continuous distribution functions against the specific alternative that there is a difference in the population variances. The disadvantage of one procedure is that it can lose its sensitivity to detect differences between variances in the presence of differences between means. The other procedure,

based on deviations from medians, poses the problem that the sampling distribution of the proposed statistic is not distribution-free under the usual randomization methods.

Virginia U. [Charlottesville].
THE ABSOLUTE CONTINUITY OF TOEPLITZ'S MATRICES, by Marvin Rosenblum. Technical note no. 14 on Contract AF 49(638)72. July 59, 15p. 14 refs. AFOSR-TN-59-735; AD-220 355.
Order from LC mi$2.40, ph$3.30 PB 143 160

Virginia U. [Charlottesville.]
MAPPING NORMS, by G. T. Whyburn. Technical note no. 13 on Topology and Mathematical Analysis, Contract AF 49(638)72. July 59, 13p. 2 refs. AFOSR TN-59-725; [AD-220 353].
Order from LC mi$2.40, ph$3.30 PB 143 506

Virginia U., [Charlottesville].
TRANSFORMATION GROUPS ON A K(π, 1) by P. E. Conner and D. Montgomery. Technical note no. 11 on Contract AF 49(638)72. June 59, 16p. 8 refs. AFOSR-TN-59-733.
Order from LC mi$2.40, ph$3.30 PB 143 161

Washington U., Seattle.
A NOTE ON HYPERCONVEXITY IN RIEMANNIAN MANIFOLDS, by Alfred Nijenhuis. Technical rept. no. 5 on Contract Nonr-277(15). 1 July 58, 12p. 2 refs.
Order from LC mi$2.40, ph$3.30 PB 142 909

Washington U., Seattle.
THEORY OF VECTOR-VALUED DIFFERENTIAL FORMS. PART II. ALMOST-COMPLEX STRUCTURES, by Alfred Frölicher and Albert Nijenhuis, Technical rept. no. 3 on Contract Nonr-477(15). [1958] 28p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 143 135

Computing Devices

David Sarnoff Research Center, Princeton, N. J.
SHIFT REGISTER TRANSISTOR, by J. T. Wallmark. Final rept. for 15 Feb 57-15 Apr 59 on Integrated Semiconductor Device Studies, Contract AF 19(604)1957. 31 May 59, 17p. 7 refs. AFCRC-TR-59-177; AD-220 315.
Order from LC mi$2.40, ph$3.30 PB 143 634

During the course of the contract work the ideas behind the shift register were broadened into a new contract - integrated electronics, the general idea being a "molding" or integration of several component functions, active as well as passive, into one piece of material, e.g. a solid. In the case of semiconductors one might talk of integrated semiconductor circuits or devices of which the shift register is an example. By applying the integrated electronics approach to other semiconductor structures a whole new class of integrated semiconductor devices using unipolar transistors was developed. The unipolar transistor, although inferior to the conventional bipolar transistor in high-frequency response and power capabilities, may offer advantages in noise and radiation tolerance under certain conditions. It has been shown possible to extend the integrated device approach also to tuned circuit functions, such as radio and communication circuits.

Digital Computer Lab., Mass. Inst. of Tech., Cambridge.
FERROELECTRICS FOR DIGITAL INFORMATION STORAGE AND SWITCHING, by Dudley Allen Buck. Master's thesis. Rept. on Contract [N5ori-60]. 5 June 52, 72p. 13 refs. Rept. R-212; ATI-174 582.
Order from LC mi$4.50, ph$12.30 PB 144 326

Materials have recently been discovered within which exist domains of permanent electric dipoles. These materials, named ferroelectrics, can be used to advantage in many electronic applications where ferromagnetic materials are currently used, often in circuits which are the duals of those of their ferromagnetic counterparts. Ferroelectrics can be made in the form of single crystals or rugged ceramics. Digital information can be stored in a matrix of ferroelectric condensers, and an efficient method of storage-element selection is available in the form of a two-coordinate, coincident-voltage scheme. The matrix can be made on a thin ferroelectric sheet by painting the coordinate rows on one side and the coordinate columns on the other. The information can be taken from the matrix via a simple mixing transformer.

Digital Computer Lab., Mass. Inst. of Tech., Cambridge.
A MAGNETIC MATRIX SWITCH AND ITS INCORPORATION INTO A COINCIDENT CURRENT MEMORY, by Kenneth H. Olsen. Rept. on Contract N5ori-60. 6 June 52, 104p. 7 refs. Rept. R-211; ATI-173898.
Order from LC mi$5.70, ph$16.80 PB 144 069

A multi-position switch, capable of handling pulses shorter than one microsecond, can be made from magnetic cores. Windings on the magnetic cores, when matrix-connected, control selection of the switch output. These windings can be excited with either direct current or pulses. This switch is capable of transmitting power efficiently, and the magnetic cores from which it is made are inexpensive and rugged, and promise reliability and long life. Two such switches pulse the 16 coordinate rows and the 16 coordinate columns of a coincident-current magnetic-core memory. The complete cycle-time of the memory, including the switch set-up time, reading of information, and re-writing of information, is less than 4 microseconds. Design of the magnetic-matrix switch is facilitated by an equivalent-circuit technique.

Eastman Kodak Co., Rochester, N. Y.
THE MINICARD INTERIM DEVELOPMENT PROGRAM, Technical rept. on Contract AF 30(602)1683. 28 May 59, 271p. 48 refs. RADC-TR-59-49; AD-213 582.
Order from LC mi$11.10, ph$42.60 PB 142 936

A serial scan code reader scheme has been proposed and compared with the present parallel scan code reader. Serial scan offers the following potential advantages: increased card code capacity, increased readout rate, broader film density tolerances, broader card positioning tolerances. It is proposed that the serial code reader use a flying spot scanner with edge following and binary pulse position modulation code. Block diagrams show how such a serial code reader might be developed. The questions of film wear and of x-radiation are examined in detail. An estimate is made of the size and complexity of a serial scan code reader.

Marine Physical Lab., Scripps Institution of Oceanography San Diego, Calif.
A SAMPLED DATA PROCESSOR, by R. A. Rasmussen. Rept. on Contracts NObsr-72512 and Nonr-2216(05). 12 Dec 58, 37p. SIO Reference 58-16.
Order from LC mi$3.00, ph$6.30 PB 143 613

This report describes a semi-automatic data sampler and computer accommodating two channels of information representing optically stored, magnetically stored, or direct electrical data in the form of time varying potentials. All data are converted to time modulated pulses and directed to a computer where a combination of analog and digital computer circuits can be adjusted to perform a variety of mathematical operations on the data with accuracies on the order of ± 0.1 percent. Results of the computations are displayed numerically on decimal totalizers, the registered numbers being proportional to the computed functions.

Mellon Inst. of Industrial Research, U. of Pittsburgh, Pa.
COMPUTER COMPONENTS FELLOWSHIP NO. 347, by W. J. Kirkpatrick and C. H. T. Wilkins. Final rept. for 1 Oct 53-30 Sep 56 on Contract AF 19(604)943. 20 Sep 57, 99p. 5 refs. AFCRC-TR-56-165; AD-98 803.
Order from LC mi$5.40, ph$15.30 PB 137 656

Small, light, low-cost, mass producible computer components were sought for performing one or more of the functions of switching, storage, selection, amplification, comparison and arithmetic or other operation on information pulses. Nonlinear resistors, saturable transformers, electroluminescence, and the effect of RF fields on gas diodes were investigated for application to electronic digital computer components. Work on nonlinear resistors resulted in adder circuits formed by printing conducting circles on opposite sides of bonded sheets of Si carbide grain. The circles were connected by printed conducting lines into matrices. Saturable transformers were used in the construction of gating circuits. A hard vacuum tube was made with a photocathode and a phosphor anode which was bistable and was triggered by light pulses. Ways were sought to make passive electronic components capable of continuous service from 200° to -60°C. It was almost impossible to print solid areas of uniform density by xerography. Conductors, capacitors, inductors, and resistors were successfully made by vacuum evaporation deposition and screen printing. The vacuum evaporation excelled for uniform thin films of metal, but SiO-SiO_2 was the only dielectric successfully deposited by this method. Chemically formed films of semiconductors appear promising because of the very low temperature coefficient of resistance in their extrinsic range.

Naval Radiological Defense Lab., San Francisco, Calif.
X Y PLOTTING WITH THE IBM MODEL 026 PRINTING CARD PUNCH, by R. Ehat and R. A. Taylor. 15 July 58, 45p. 1 ref. Research and Development technical rept. USNRDL-TR-258.
Order from LC mi$3.30, ph$7.80 PB 143 092

An IBM Model 026 Printing Card Punch has been adapted to operate into a Mosely Model 30A card Translator and a Mosely Model 2 Recorder. The design permits the plotting of IBM card information on an XY Plotter (Mosely Model 2) without disabling the normal card punching and card duplicating functions of the IBM Model 026 Printing Card Punch.

Naval Research Lab., Washington, D. C.
DIGITALIZED PICKOFF DISPLAY CONVERTER, by F. R. Fluhr. Interim rept. 11 Mar 59, 5p. Rept. 5281.
Order from LC mi$1.80, ph$1.80 PB 138 311

As Naval Data Handling Systems become larger and more complex, data processing becomes more efficient when accomplished by digital methods. Most such systems require manual monitoring and override capabilities in data insertion, detection, tracking, and computing functions. One means by which an operator can insert and correct target track data as displayed on a radar plan-position indicator is through the use of the Pickoff Display Converter. A digitalized PDC can convert an operator's positioning of an inserted marker displayed on the PPI with the radar video into the digit values representing the marker coordinates. The positioning of the marker is accomplished by positioning a probe on the surface of a conducting-glass PPI overlay. When the operator lifts the probe, the marker coordinate values are transferred to the main computer. The proposed digitalized PDC can be made to operate so that the probe will move the PPI marker in a direct 1:1 relationship or in a vernier-differential relationship.

Naval Research Lab., Washington, D. C.
SOLUTION OF SYSTEMS OF SIMULTANEOUS LINEAR EQUATIONS ON THE NAREC, by Benjamin Lepson and Janet P. Mason. Interim rept. 23 Oct 59, 16p. 1 ref. NRL Rept. 5372; NAREC ref. no. 20.
Order from LC mi$2.40, ph$3.30 PB 140 974

The solution of large systems of simultaneous linear equations is a necessary part of many research, development, and design projects. Although several methods are known for obtaining such

solutions, the amount of computation necessary may be quite large. One of the standard methods, usually referred to as Gaussian elimination, has been adopted for high-speed computation and programmed for the NAREC. This can be used to solve, in a few minutes, systems of equations with as many as fifty-four unknowns. Several versions of this program are described in detail with instructions for their use.

Naval Research Lab., Washington, D. C.
SYMBOLIC ADDRESS-SYMBOLIC OPTIMUM PROGRAMS FOR A DRUM-MEMORY COMPUTER, by J. K. Russell. Interim rept. 23 Oct 59, 42p. Rept. no. 5377.
Order from OTS $1.25 PB 151 999

Because of the man-hours involved, lengthy computer programs are rarely time-optimized. It is found that the optimizing process for a computer with magnetic drum memory is itself a computable process. A program for the Royal McBee LGP-30 has been developed which performs the optimizing process on a data program written in a simple symbolic language (memory locations symbolized rather than specified). Although the data program is lengthened 2 to 5 times, it is 1/4 to 1/3 faster. Because of the length and lack of sequence in the resultant program, it is felt that an additional program is necessary to translate the symbolic language directly to unoptimized computer language (memory locations specified), for ease in troubleshooting. Such a program has also been developed. Examples of the symbolic language are given as well as the results of processing by the two programs.

MECHANICS

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF A METHOD TO DETERMINE PLASTIC STRAINS AND STRESSES USING BRITTLE COATINGS, by Kenneth E. Hofer, Jr. and A. J. Durelli. Final rept. on Contract DA 11-022-ORD-2346. June 59, 90p. 39 refs.
Order from LC mi$4.80, ph$13.80 PB 143 624

The experimental stress analysis method, of brittle coatings is used to determine the directions of the principal stresses in a plastically yielded specimen. A device for measuring the strain sensitivities of low sensitivity brittle coatings was constructed. This device was used to determine the strain sensitivity of several grades of "Stresscoat". Various resinous and ceramic coatings are used to detect Lueders' lines and their qualities are compared with each other.

Brown U. Div. of Applied Mathematics, Providence, R. I.
NUMERICAL CALCULATION OF SLIP-LINE FIELDS, by Thomas M. Downie. Technical rept. no. 45 on Contract Nonr-562(10). Nov 58, 65p. 15 refs. C11-45.
Order from LC mi$3.90, ph$10.80 PB 143 411

This paper is concerned with the quantitative values of slip-line fields in plane plastic flow. In particular, the coordinates of slip-line fields determined by two circular arcs are calculated. There are many problems in plasticity where the field is determined by two circular arcs of equal radii. An example is the extrusion of metal through a square die.

Brown U. Div. of Applied Mathematics, Providence, R. I.
NUMERICAL SOLUTIONS FOR ELASTIC-PLASTIC BEAMS BY METHOD OF CHARACTERISTICS, by R. C. Alverson. Technical rept. no. 46 on Contract Nonr-562(10). Dec 58, 106p. 32 refs. C11-46.
Order from LC mi$5.70, ph$16.80 PB 143 612

This report is concerned with the solution of problems of impact or dynamic loading of a beam such that extensive plastic deformation takes place. The main purpose of the present work is to explore the usefulness in such problems of a numerical treatment based on the Timoshenko beam equations in the elastic sections, and using integration techniques of the method of characteristics. The beam is assumed to obey laws of ideal plasticity; effects of strain-hardening, of rate of strain, and of shear force on the plasticity condition are neglected. A particular type of impact problem was solved numerically for several combinations of the load and beam parameters, and the computed results are contrasted with experimental results and with those of simple plastic-rigid analyses.

Brown U. Div of Applied Mathematics, Providence, R. I.
ON THE PROPAGATION OF STRESS IN A HALF-SPACE, by J. W. Craggs. Technical rept. no. 44 on Contract Nonr-562(10). Oct 58, 31p. 9 refs. C11-44.
Order from LC mi$3.00, ph$6.30 PB 143 785

The purpose of the present exposition was to develop a method of solution for elastic problems which is, in principle, capable of extension to the plastic-elastic case. However the solution for the elastic half-space proves to supplement previous solutions in certain respects, emphasising the importance of Rayleigh waves, and giving the stress and velocity components without complicated contour integration. The solution is therefore presented by itself for its own intrinsic interest.

Brown U. Div. of Engineering, Providence, R. I.
THE FRACTURE OF BRITTLE AND QUASI-BRITTLE MATERIALS: A SURVEY, by J. Gurland. Rept. on Contract DA 19-020-ORD-4888. Aug 59, 58p. 63 refs. DA-4888/1.
Order from LC mi$3.60, ph$9.30 PB 143 627

This survey summarizes some of the prevalent views on the theory, behavior, testing and design of brittle materials, with the absence of plastic deformation and the origin of fracture, and the problems of testing and the characteristic features of brittle behavior.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
PLASTICS STRESS CONCENTRATION AT A CIRCULAR HOLE IN AN INFINITE SHEET SUBJECTED TO EQUAL BIAXIAL TENSION, by Bernard Budiansky and O. L. Mangasarian. Technical rept. no. 3 on Contract Nonr-1866(02). Dec 58, 26p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 143 609

With the use of J_2 deformation theory, the stress-concentration factor at a circular hole in an infinite sheet of strain-hardening material subjected to equal biaxial tension at infinity is found for a variety of representative materials. The analysis exploits a transformation which permits the calculation of the stress-concentration factor without determining the stress distribution in the sheet. Subsequent calculations reveal, that for a monotonically increasing applied stress, the stress-history at all points in the sheet is nearly radial.

Institute of Flight Structures, Columbia U., New York.
ON A DYNAMICAL SAINT-VENANT PRINCIPLE, by Bruno A. Boley. Technical rept. no. 12 on Contract Nonr-266(20). Dec 58, 20p. 7 refs. CU-12-58-ONR266(20)-CE.
Order from LC mi$2.40, ph$3.30 PB 143 618

The dynamic behavior of a simple mechanical model composed of two Timoshenko beams connected by springs is studied. The accuracy of a quasi-static solution and of Saint-Venant's principle is studied for various rates of load application.

Massachusetts Inst. of Tech., Cambridge, Mass.
ELASTIC-PLASTIC TORSION OF A CIRCUMFERENTIALLY NOTCHED BAR, by J. B. Walsh and A. C. Mackenzie. Rept. on Contract AF 18(600)957. [1958] 26p. 10 refs. AFOSR-TN-59-710.
Order from LC mi$2.70, ph$4.80 PB 143 677

The elastic-plastic torsion of a cylindrical bar with a circumferential notch is investigated. Theoretical predictions of angle of twist and notch root strain are compared with experimental values.

Massachusetts Inst. of Tech., Cambridge.
ON NOTCH SENSITIVITY, by Frank A. McClintock. Rept. on Contract AF 18(600)957. 9 May 59, 33p. 23 refs. AFOSR-TN-59-712; AD-225 364
Order from LC mi$3.00, ph$6.30 PB 143 676

Experiments on pure aluminum are in agreement with the fully plastic theory. Experiments on 7075 aluminum alloy and 4140 steel show a notch sensitivity, with a crack behavior and size effect similar to that predicted from elastic-plastic analysis.

Massachusetts Inst. of Tech., Cambridge.
THE SINGLY-GROOVED, PLANE STRAIN TENSILE TEST, by Frank A. McClintock. Rept. on Contract AF 18(600)957. [1959] 27p. 14 refs. AFOSR-TN-59-713.
Order from LC mi$2.70, ph$4.80 PB 143 675

The distributions of stress and strain around a single groove in a plane strain specimen subject to fully plastic tension are found theoretically. The distinguishing features of this configuration are the lack of triaxiality and the constant strain pattern as the specimen separates. The transition temperature is lower than in the Charpy test, and a shear lip is absent.

Minnesota U., Minneapolis.
STEADY STATE UNDAMPED VIBRATIONS OF A CLASS OF NONLINEAR DISCRETE SYSTEMS, by P. R. Sethna, B. E. Fristedt, and V. G. Harvester. Rept. for Jan 58-Jan 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)2803. Aug 59, 37p. 10 refs. WADC Technical rept. 59-141.
Order from OTS $1.00 PB 161 129

Steady state vibrations of a class of nonlinear discrete systems with an arbitrary number of degrees of freedom are studied. The coordinates of the system are first transformed to the principal coordinates corresponding to the linear part of the system. A perturbation scheme is used to obtain the solutions. Some special effects of the ratios of the linear natural frequencies on the qualitative nature of the solutions are demonstrated. Solutions are obtained for some specific problems and the results are checked against those obtained from an analog type computer.

Naval Research Lab., Washington, D. C.
NOTES ON DYNAMICS OF LINEAR ELASTIC STRUCTURES, by G. J. O'Hara. Interim rept. 23 Oct 59, 19p. 10 refs. NRL rept. 5387.
Order from OTS $0.50 PB 151 933

Normal-mode theory is a recognized method of calculating the dynamic response of linear elastic structures. This report gathers together many of the important theorems, some of which have not been previously published in NRL reports, and explains and discusses them. Included is a section on Duhamel integrals for a linear simple oscillator exhibiting many of the important forms which are rarely seen. Characteristic shape or normal load theorems are also discussed, and a more exact method of stress-checking a structure is proposed.

Pennsylvania State U., University Park.
CORRELATIONS BETWEEN TRANSVERSE AND TORSIONAL SHEAR CREEP DEFORMATIONS, by Joseph Marin. Rept. for Mar-Dec 57 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)2729. June 59, 35p. 5 refs. WADC Technical rept. 57-755; AD-226 375.
Order from OTS $1.00 PB 161 258

The creep deformation of a rivet subjected to transverse shear depends, among other factors, upon the rivet diameter and rivet length. This influence of size means that each particular rivet configuration must be tested to obtain the transverse shear-creep deformation. A more basic approach would be to predict the transverse shear-creep of a rivet in terms of the more fundamental case of pure shear as

represented by torsion. A theory is developed for predicting the transverse shear-creep deformation of a rivet in terms of pure torsional shear-creep. The correlation of transverse shear and pure torsion shear is made, based on both the torsion of a solid circular bar and the torsion of a thin-walled circular tube. From the theory developed, it is also possible to obtain the creep deflection of a rivet from the creep constants in pure shear or simple tension.

Space Research Labs., Litton Industries, Beverly Hills, Calif.
RESEARCH PROGRAM ON HIGH VACUUM FRICTION. Final rept. on Contract AF 49(638)343. 30 Mar 59, 159p. 71 refs. Pub. no. 1023; AFOSR-TR-59-97.
Order from OTS $3.00 PB 161 116

The principal test condition studied was that of the linear motion between two dry, clean, unlubricated, flat surfaces. Microscopic examination of sliding contact between two clean, machined surfaces led to the conclusion that each individual contact area was largely point-to-plane. Models could be loaded to yield pressures, and under certain conditions could be made to slide with abnormally low friction forces and without microscopic evidence of wear or surface distortion. A theory of friction has been postulated, based principally on the analysis of these tests.

Utah U., Salt Lake City.
A SPECIAL CASE OF CONTACT ELASTICITY, by W. Komkov. Technical rept. no. 5 on Contract Nonr-1288(02). Nov 58, 42p. 27 refs.
Order from LC mi$3.30, ph$7.80 PB 143 472

The purpose of this study was to determine the distribution of stresses in the piston and in the body of the material subjected to the high pressure due to the action of the piston throughout the elastic range and to determine the planes of formation of the plastic condition. The problem is reduced to a determination of elastic stress conditions in a three-dimensional axially symmetrical case. The main problem of contact elasticity which is treated in this paper is closely related to the so called Boussinesq problem. An extensive literature exists in this field and this complexity of theoretical approach may be judged by the array of famous names in the field of mathematics and engineering, directly connected with the closely related problems of three-dimensional elasticity.

Yale U., New Haven, Conn.
EXPERIMENTAL DETERMINATION OF CORNERS IN THE YIELD SURFACE, by Aris Phillips and George A. Gray. Technical rept. no. 5 on Contract Nonr-609(12). Dec 58, 67p. 16 refs.
Order from LC mi$3.90, ph$10.80 PB 143 848

Combined stress tests with variable stress ratios on annealed commercially pure aluminum made on a combined tension-torsion testing machine of a dead load type. The experiments indicate that the form of the yield surface at a considerable distance from the stress increment vector agrees much better with the prediction of the slip theory than it does with the prediction of the Mises theory.

Aerodynamics and Pneumatics

PREMIER SYMPOSIUM INTERNATIONAL SUR L'AÉRODYNAMIQUE ET L'AÉROTHERMIQUE DES GAZ RARÉFIÉS; RÉSUMÉS DES CONFÉRENCES ET COMMUNICATIONS, 2-5 JULY, 1958. 65p. 57 refs. AFOSR-TN-58-983; AD-205 874.
Order from LC mi$3.90, ph$10.80 PB 138 625

Abstracts (some in French) of papers presented.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
ON THE AEROELASTIC CHARACTERISTICS OF LOW ASPECT RATIO WINGS WITH CHORDWISE DEFORMATIONS, by John Dugundji and John D. C. Crisp. Rept. on Contract AF 49(638)219. July 59, 205p. 61 refs. ASRL Technical note 74-3; OSR Technical note no. 59-787.
Order from LC mi$9.30, ph$31.80 PB 143 960

An investigation is made into the nature of chordwise flutter and divergence characteristics of low aspect ratio wings. To this end, two simple low aspect ratio configurations are examined in considerable detail. The first is a cantilever rectangular wing possessing a bending, a torsion, and a first chordwise bending mode. The second is a free-free delta wing of sufficiently low aspect ratio so that spanwise deformations can be neglected. Some effects of aerodynamic heating and longitudinal accelerations on these planforms are also examined. Simple closed form solutions are developed for the flutter and divergence characteristics wherever appropriate. The general trends revealed by these analyses may prove to be of interest to persons involved in the interpretation of aeroelastic analyses of such surfaces. Among the more interesting trends indicated was the role played by mass density ratio for the delta wings. At the lower mass density ratios, more chordwise modes had to be included in the modal type analyses. Also, for high mass density ratios, the flutter characteristics became dependent on dynamic pressure q and independence of the mass density ratio.

Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DATA REDUCTION TECHNIQUES FOR FLIGHT VIBRATION MEASUREMENTS, by D. C. Kennard, Jr. and C. E. Thomas. Rept. on Environmental Criteria for Flight Vehicles and Related Equipment. Feb 59, 23p. 2 refs. WADC Technical note 59-44; AD-210 478.
Order from LC mi$2.70, ph$4.80 PB 144 204

The system used at Wright Air Development Center for recording and analyzing flight vibration data is described. It has made possible a significant increase in the quantities of raw data which can be acquired to define the vibration and sound environments in various aircraft. To reduce the large quantities of data to usable form, processing techniques have been evolved based upon the use of standard business machines and the ERA 1103 Computer. These techniques are described and methods are illustrated for presenting

data to define spectral and statistical qualities of the sound and vibration environment. A proposed system to provide still further automation of the data reduction process is described briefly. It is concluded that these recent advances in state-of-the-art make possible the acquisition of sufficient data to eliminate eventually the present inexact methods of estimating sound and vibration environments of aircraft and missiles.

Air Force Flight Test Center, Edwards AFB, Calif.
STANDARDIZATION OF TAKE-OFF PERFORMANCE MEASUREMENTS FOR AIRPLANES, by Kenneth J. Lush. [1948] 102p. 1 ref. Technical note R-12.
Order from LC mi$5.70, ph$16.80 PB 144 149

Formulae are derived by which take-off performance measurements may be standardized. These formulae are easy to use and they apply, with suitable numerical constants, to airplanes with any type of propulsive system, including mixed types and types using part-time assistance or boost. Numerical constants are proposed for use with these formulae. Experimental data available support these constants, but are insufficient to check them completely.

Air Force Missile Development Center, Holloman AFB, N. Mex.
GRAVITY SURVEY OF THE HOLLOMAN TRACK, by Ray L. Larkins and Frank J. Calkum. July 59, 25p. 3 refs. AFMDC-TR-59-31.
Order from LC mi$2.70, ph$4.80 PB 143 183

Tests of inertial guidance systems on the Holloman track require a precise knowledge of the gravity force. This report describes the instrument used, the evaluations of the measurements, and tabulates theoretical gravity, observed gravity, free-air anomaly, and Bouguer anomaly along the seven miles of the Holloman track.

Arnold Engineering Development Center [Tullahoma, Tenn.]
USE OF PERFORATED WALLS FOR SHOCK CANCELLATION AT SUPERSONIC SPEEDS, by H. Ramm and M. Jones. Rept. on ARO, Inc. Contract AF 40(600)800. Aug 59, 97p. 8 refs. AEDC-TR-59-15.
Order from LC mi$5.40, ph$15.30 PB 143 276

Tests have been conducted in the 1-Foot Supersonic Model Tunnel of the Propulsion Wind Tunnel Facility, AEDC, to determine shock cancellation characteristics of perforated walls at supersonic Mach numbers up to 3.15. The test section wall configurations investigated included walls with holes drilled normal to the wall surface and with holes slanted 60 deg to obtain differential resistance for inflow and outflow. Theoretical considerations helped to separate the influences that tend to make the wall characteristics nonlinear in an undesirable sense. These influences were found to be the ratio of the boundary layer thickness to hole diameter and the pressure recovery in the holes. Tests with two and three-dimensional models showed the feasibility of satisfactory shock cancellation for at least moderate model blockage values. Models with more than 4 percent blockage may require special means of improving the cancellation of the expansion waves following the bow wave compression.

Bell Aircraft Corp. [Buffalo, N. Y.]
CHEMICAL NON-EQUILIBRIUM EFFECTS IN THE LAMINAR HYPERSONIC BOUNDARY LAYER, by George R. Inger. Doctoral thesis. Rept. for June-Oct 58 on Contract AF 49(638)380. 30 Mar 59, 139p. 22 refs. Rept. no. 7010-6; AFOSR-TN-59-237; AD-212 007.
Order from LC mi$6.90, ph$21.30 PB 143 588

In view of the importance of dissociation-recombination chemistry of a flowing air mixture to the accurate calculation of aerodynamic design data, such as heat transfer, real gas dynamics research has focused attention on the theoretical study of the chemical non-equilibrium laminar boundary layer. The present report is concerned with the basic foundations of such studies - in particular, some new theoretical representations of a dissociating air mixture and a new method of non-equilibrium boundary layer solution are presented.

Bureau Technique Zborowski, Brunoy (France).
THEORETICAL INVESTIGATION AND EXAMINATION BY MEASURING TESTS IN WHAT A DEGREE THE ECONOMY OF FLYING VEHICLES IS INFLUENCED BY PRE-CAMBERED SKELETONS OF AIRFOILS CLOSED IN THEMSELVES. Final Technical rept. for 1 July 58-31 July 59 on Contract DA 91-508-EUC-393. 10 Aug 59, 68p. 17 refs.
Order from LC mi$3.90, ph$10.80 PB 143 446

The economy of high-speed flying vehicles depends not only on the choice of adequate profiles and wing dimensions as aspect ratio and span, but also and even more on the possibility of flight with reduced velocities at still acceptable lift-drag ratios as well as on good manoeuvring properties without risk of stall. Although ring airfoils present, in this domain, well-known advantages over plane wings, as e. g. lower induced-drag values for equal lift and aspect ratio and less inclination to stall phenomena, it seems worth while to apply to them the same devices as utilized in plane-wing theory by MALAVARD, i. e. precambering of the wing center-lines to guarantee a favorable behavior of the airfoil at a particularly interesting lift value ("adaptation" value).

California U., Berkeley.
VECTOR POLAR METHOD FOR SHOCK INTERACTIONS WITH AREA DISTURBANCES, by A. K. Oppenheim and P. A. Urtiew. Technical note no. DR 4 on Contract AF 49(638)166. July 59, 157p. 29 refs. AFOSR-TN-59-701.
Order from LC mi$7.50, ph$24.30 PB 143 670

The application of the vector polar method to the study of interactions between plane traveling shock waves and area disturbances involves the introduction of steady flow polars. The solutions obtained by the vector polar method are shown to compare favorably with analytical and experimental results obtained by

other investigators who studied the interactions of shocks with a variety of obstacles, such as grids and gauzes, in shock tubes.

Carnegie Inst. of Tech., Pittsburgh, Pa.
STUDIES RELATING TO CONDENSATION TRAILS. Final rept. on Contract AF 19(604)1944. July 59, 72p. 15 refs. AFCRC-TR-59-257, AD-217616
Order from LC mi$4.50, ph$12.30 PB 143 658

Three studies of importance in the analysis and understanding of condensation trail phenomena have been made. The first is an experimental determination of the effect of hygroscopic nuclei on the size and concentration of water drops in a contrail. The second is an analysis of the numerical evaluation of the equations of drop growth. In the third, a new theory of nuclei growth is presented, based on the kinetic theory of gases.

David Taylor Model Basin, Washington, D. C.
CONTRIBUTION TO THE THEORETICAL INVESTIGATION OF BLOWING AT THE TRAILING EDGE OF A WING PROFILE (Contribution a l'Etude Theoretique du Soufflage au Bord de Fuite d'un Profil d'Aile), by L. Malavard, tr. by S. T. de los Santos. July 55, 46p. ONERA Note Technique 4/1727 A; DTMB Aero rept. 879.
Order from LC mi$3.30, ph$7.80 PB 138 994T

Institute for System Research, U. of Chicago, Ill.
AERODYNAMIC STUDIES: THE FORCES ACTING IN AN AIR VEHICLE: A REVIEW OF THE LITERATURE [PART 22] by M. Z. Krzywoblocki. Rept. for Apr-June 57 on Scientific and Engineering Research Investigations in Flight Dynamics, Contract AF 33(616)5689. Aug 59, 311p. 1438 refs. WADC Technical note 56-360, Part 22. [AD-227 136]
Order from OTS $5.00 PB 161 140

This work is an annotated bibliography of the scientific literature pertaining to methods of calculating the aerodynamic forces acting on an air vehicle in flight. The present segment of the work includes material reviewed by the author in the period April 1957 through June 1957. The more interesting papers and reports (from the viewpoint of the aerodynamicist) are discussed briefly; others are listed without comment. (See also PB 161 000-001).

Institute of Engineering Research, U. of California, Berkeley.
LIFT AND DRAG ON CONE CYLINDERS, by T. Nark. (Doctoral thesis). Rept. on Contract Nonr-222(45). 30 Dec 57, 43p. 10 refs. Rept. no. HE-150-154; Series no. 20, issue no. 117; AD-155 159.
Order from LC mi$3.30, ph$7.80 PB 138 634

The normal and axial forces were measured on a cone-cylinder body of revolution in a supersonic, rarefied gas flow at a Reynolds number of 4050 and Mach number of 4.0. The angle of attack was varied to a maximum of sixteen degrees. The final results, plotted in coefficient form, were compared to Newtonian hypersonic theory for an inviscid fluid. The test was conducted at such low Reynolds numbers that the Newtonian theory did not adequately represent the axial forces, but when a skin friction correction was applied to the theory, the experimental data are within 15 percent of the predicted values. The normal force coefficient was adequately predicted by the Newtonian theory, with the maximum error above 8 degrees being 10 percent.

Just, W.
A PRELIMINARY AERODYNAMIC STUDY OF THE HIGHSPEED-LONGRANGE-VTOL "JIFFY" OF MR. E. LAGELBAUER, by W. Just and H. Georgi. Final technical rept. no. 1 15 Mar-15 July 59, on Contract DA 91-591-EUC-1083, OI-1307-59. [1959] 82p. 2 refs.
Order from LC mi$4.80, ph$13.80 PB 143 602

This paper deals with the investigation into the capacities of the vertical-take-off-aircraft "Jiffy" suggested by E. Lagelbauer, during hovering, at vertical climbing, as well as in horizontal flight at low speeds, employing fixed rotors with unvariable blade angles of pitch. Following an introductory chapter as to layout, abbreviations, and design parameters the rotor coefficients are computed for hovering, vertical climbing, and horizontal flight, and the performance calculations are executed. The results of these calculations are shown on diagrams. The result of this aerodynamical investigation of the rotor has shown that, with the project proposed of a vertical-take-off-aircraft, satisfactory flight characteristics can be obtained only by employing a tiltable wing whereby the wing must be tilted by about 25° to 40° (with, and without, flap displacement), depending on whether the aircraft is operating in its state as helicopter or convertiplane. In its structural design, the aircraft thus resembles a tilting wing aircraft whereby, however, additional difficulties will have to be overcome on account of the shutting-off of the rotors. From the aerodynamical point of view this project can be realized. The definite acceptability of this project, however, can be established only through additional extensive investigations.

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
EFFECTS OF AIR DISSOCIATION AND IONIZATION AT HYPERSONIC SPEED, by Gianna Jarre. Technical note 14 on Contract AF 61(514)1124. July 59, 37p. 8 refs. AFOSR-TR-59-119.
Order from LC mi$3.00, ph$6.30 PB 143 910

This paper deals with the problem of dissociation and ionization of air components at the high temperatures produced by hypersonic speed, either behind a strong normal shock wave or at the wall of an adiabatic flat plate. The state of chemical equilibrium is studied with the aid of a thermodynamic chart of atmospheric air and using simplified schemes of real flows. The dynamic problem of relaxation is also investigated but only in the field of oxygen dissociation. Simplified methods for calculating the length of the relaxation processes are developed, discussed and applied to numerical examples.

National Research Labs., Ottawa (Canada).
APPROXIMATE METHOD FOR DETERMINING THE POTENTIAL FLOW ABOUT AN ARBITRARY AEROFOIL SECTION IN A TWO-DIMENSIONAL FINITE STREAM WITH PARTICULAR REFERENCE TO LARGE STREAM DEFLECTIONS, by D. G. Gould. Aug 59, 43p. 8 refs. Aeronautical rept. LR-260.
Order from LC mi$3.30, ph$7.80 PB 143 576

The flow about and on the surface of an aerofoil section in a finite stream and that about and on the surface of the same aerofoil section in an infinite symmetrical cascade are compared. It is shown that, for most cases of practical interest, the differences are small for stream deflection angles up to 90 degrees. Thus, the approximate flow about an arbitrary aerofoil section in a two-dimensional finite stream may be obtained by using the methods existing for the determination of the flow about an arbitrary section in a cascade. The procedure, as applied to the finite stream approximation, is given using the interference method of cascade theory.

National Research Labs., Ottawa (Canada).
METHODS OF MEASUREMENT OF AIRCRAFT DYNAMIC STABILITY DERIVATIVES, by K. Orlik-Rückemann. July 59, 57p. 217 refs. Aeronautical rept. LR-254.
Order from LC mi$3.60, ph$9.30 PB 143 578

The numerous methods available for determination of dynamic stability derivatives of aircraft are presented and grouped according to a convenient classification system. Both free flight and wind tunnel methods are considered. The basic aspects of each method are described in the text and illustrated by a schematic drawing. Detailed information can be obtained from a rather extensive bibliography, arranged according to the same classification system.

Naval Ordnance Lab., White Oak, Md.
TEMPERATURE RECOVERY FACTORS ON A 40-DEGREE CONE CYLINDER WITH TURBULENT BOUNDARY LAYER AT MACH NUMBERS 4.1 AND 4.8, S. M. Dmohoski. 20 Aug 57, 26p. 20 refs. Aerodynamics Research rept. 22; NAVORD rept. 5763.
Order from LC mi$2.70, ph$4.80 PB 143 309

Temperature recovery factors have been measured on the cylindrical surface of a 40-degree cone cylinder with turbulent boundary layer. The measurements were made with and without a turbulence promoter immediately upstream of the nozzle in the NOL Continuous 40 x 40 cm Aeroballistics Wind Tunnel No. 2 at Mach numbers 4.1 and 4.8. Though turbulent recovery factors have been studied extensively at lower Mach numbers, only isolated investigations have been reported at Mach numbers of 4 and above. However, the results of the present experiments demonstrate essentially the same effects observed at lower Mach numbers, i.e., the turbulent recovery factor is approximately equal to the cube root of the Prandtl number.

Princeton U., N. J.
EXPERIMENTAL STUDIES AT MACH NUMBERS 12 TO 19 OF CONICAL AND BLUNTED BODIES AT ZERO ANGLE OF ATTACK, by S. M. Bogdonoff and I. E. Vas. Rept. on Contract AF 18(600)498. Sep 58, 63p. 8 refs. Rept. no 435; AFOSR-TN-58-841; AD-203 181.
Order from LC mi$3.90, ph$10.80 PB 143 655

An experimental study on conical and blunted bodies was carried out at Mach numbers between 12 and 19 using the Princeton University Helium Hypersonic Tunnel. Pressure distributions and Schlieren photographs were obtained for bodies with cone half angles varying from 10^{o} to 45^{o}. Comparison with the theoretical inviscid and Newtonian pressures corrected for normal shock losses were made. The pressures on a body without corners can be predicted quite well. A corner at the junction of the nose section and conical afterbody results in large variations between the measured values and predicted ones. The pressures on the conical bodies were not affected by the nose shape for that part of the body downstream of a station located at 1 1/2 times the nose bluntness diameter.

Rensselaer Polytechnic Inst., Troy, N. Y.
NONEQUILIBRIUM FLOW IN GAS DYNAMICS, by T. Y. Li. Rept. on Contract AF 18(600)1591. May 59, 57p. 35 refs. TR AE 5901; AFOSR-TN-59-389; AD-213 893.
Order from LC mi$3.60, ph$9.30 PB 143 516

The present paper consists mainly of three parts. The first part deals with general concepts which include (1) the fundamental equations and boundary conditions in problems of steady adiabatic inviscid flow of a reacting mixture of perfect gases and (2) a general study of the chemical relaxation in a gaseous system. The second part deals with the steady one dimensional nozzle flow with nonequilibrium chemical reactions. An important nondimensional parameter is used to classify the nozzle flow into (1) equilibrium flow (2) nonequilibrium flow and (3) frozen flow. Significant departure from equilibrium flow in a hypersonic shock tunnel nozzle would lead to frozen flow further downstream. The third part presents a numerical method whereby the inviscid adiabatic flow of a reacting mixture of perfect gases past a blunt body may be calculated. Numerical examples show that significant changes in the flow conditions of the shock layer region can be attributed to the chemical nonequilibrium effects.

Hydrodynamics, Hydraulics, and Hydrostatics

Applied Mathematics and Statistics Lab., Stanford U., Calif.
WAVE GENERATION BY OSCILLATION OF SUBMERGED BODIES, by Harold Levine. Technical rept. no. 79 on Contract Nonr-225(11). 19 Nov 58, 39p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 143 408

This paper deals with some two-dimensional hydrodynamic problems of an ideal, incompressible fluid.

The fluid is assumed infinitely deep and to possess a horizontal free surface when a state of equilibrium in the field of gravity prevails. A steady motion of the fluid will result if there is a submerged contour which oscillates periodically, and waves are generated on the free surface. The large wave motions pose a formidable calculation, and it is therefore customary to assume that the oscillations of the contour and hence the wave amplitudes are infinitesimal. Then the problem is one of potential theory, with linear boundary conditions imposed at the fixed, equilibrium positions of the free surface and immersed contour.

David Taylor Model Basin, Washington, D. C.
CENTROID AND MOMENT OF INERTIA OF A SUPERCAVITATING SECTION, by W. B. Morgan. Aug 57, 20p. 6 refs. Rept. no. 1193.
Order from LC mi$2.40, ph$3.30 PB 138 642

Equations are derived by numerical integration for the ordinate of the centroid and moment of inertia about the x_o-axis of Tulin's SC section with the TMB modified thickness distribution. These equations are evaluated for a flat face section and for a section with a given relationship between design lift coefficient and design angle of attack. The results are plotted in a form convenient for propeller blade stress analysis.

David Taylor Model Basin, Washington, D. C.
THE DESIGN AND ESTIMATED PERFORMANCE OF A SERIES OF SUPERCAVITATING PROPELLERS, by A. J. Tachmindji and W. B. Morgan. July 58, 58p. 26 refs.
Order from LC mi$3.60, ph$9.30 PB 143 563

This paper outlines the procedure which has been developed for the design of supercavitating propellers and the possible range of application in which such propellers can be used. This design method has been used to predict the performance characteristics of a series of supercavitating propellers and compared with specific experimental results.

David Taylor Model Basin, Washington, D. C.
OPTIMUM SUPERCAVITATING SECTIONS by W. B. Morgan. Aug 57, 23p. 9 refs. Rept. C-856; AD-145 538.
Order from LC mi$2.70, ph$4.80 PB 138 643

If both the cavitation and friction drag of a supercavitating (SC) section are considered, a minimum drag-lift ratio occurs at a specific lift coefficient. This lift coefficient is mainly dependent on the type of SC section being considered.

David Taylor Model Basin, Washington, D. C.
A PHASE-COMPONENT MEASUREMENT SYSTEM, by R. G. Tuckerman. Apr 58, 25p. 3 refs. Rept. 1139.
Order from LC mi$2.70, ph$4.80 PB 144 206

This report describes an instrumentation system developed to indicate directly the first-order Fourier coefficients of the heaving force and pitching moment acting on a ship model when it is forcibly displaced. Provision is made for indicating the coefficients of the second or the third harmonics when desired. Direct recording of the force and moment signals is also provided. The report includes schematic diagrams, photographs, and operating instructions.

Experimental Towing Tank, Stevens Inst. of Tech., Hoboken, N. J.
THE FORCE CHARACTERISTICS OF SURFACE-PIERCING FULLY VENTILATED DIHEDRAL HYDROFOILS, by Peter Ward Brown. Rept. on Contract Nonr-263(20). Oct 58, 68p. 10 refs. Rept. no. 698.
Order from LC mi$3.90, ph$10.80 PB 143 209

Results of a theoretical and experimental investigation of the characteristics of surface-piercing, fully ventilated dihedral hydrofoils are presented. A range of dihedral angles from 20 to 40 degrees is covered in the experimental investigation. Good agreement between experiment and theory is obtained, the theory being applicable to surface-piercing, fully ventilated dihedral hydrofoils of zero sweep, taper and twist. The report includes experimental evidence and an analysis of cambered sections with partially attached flow to the upper surface.

Iowa Inst. of Hydraulic Research, Iowa City.
THE IOWA TOWING TANK, by Milton Martin. Rept. on Contract Nonr-1611(01). 1 Nov 58, 10p.
Order from LC mi$1.80, ph$1.80 PB 143 473

The towing tank of the Iowa Institute of Hydraulic Research at the State University of Iowa has now been in operation for approximately one year. It is being used for research in both naval and hydraulic problems. The design and construction of this new facility involved some novel features which should be of interest to other designers. A detailed discussion of these features will be included.

Rensselaer Polytechnic Inst., Troy, N. Y.
FINITE CAVITY CASCADE FLOW, by Hirsh Cohen and C. D. Sutherland. Rept. on Contract Nonr-591(08). 2 Apr 58, 30p. 13 refs. RPI Math Rep no. 14.
Order from LC mi$2.70, ph$4.80 PB 139 211

The problem considered in this paper is the steady flow of incompressible, non-viscous fluid past an infinite array of lifting foils under such conditions that fully-developed cavities appear on the foil surfaces. The discussion here will be limited to two dimensional flow past foils set at small angle of attack. Such cavitating cascade flows are of interest in many types of internal and external flow machines - axial compressors, propellers, and other multi-bladed devices.

Wichita U. [School of Engineering] Kans.
CONTRIBUTIONS TO JET PUMP THEORY, by H. B. Helmbold. Rept. on Contract Nonr-201(01). Sep 57, 105p. 4 refs. Rept. no. 294, supersedes Engineering Studies 105, 106, 107, 118, 137, 145.
Order from LC mi$5.70, ph$16.80 PB 138 959

Contents:
Part I. Comparison of ideal mixing processes
Part II. Integral relations on mixing processes
Part III. Simplified theory of mixing-zone spreading
Part IV. Approximate theory of jet diffusion in a constant-pressure mixing tube
Part V. Simplified theory of the plate jet in a parallel stream under constant pressure
Part VI. Perfect mixing processes in subsonic jet pumps

METALLURGY

Birmingham U. (Gt. Brit.)
RESEARCH ON STRAIN-AGING, HARDENING, AND SOFTENING OF METALS BY FATIGUE, by G. W. J. Waldron and J. M. Summerton. Technical summary rept. for Sep 57-Feb 59 on Contract AF 61(514)1182. [1959] 128p. 56 refs. AFOSR-TN-59-774; AD-219 717.
Order from LC mi$6.30, ph$19.80 PB 143 959

Increasing magnesium content reduces the width of slip marks which occur during fatigue, and the amount of surface cracking is also reduced. Experiments at -196°C have shown hardening and softening effects which it is suggested are due to interactions of vacancies and solute atoms with dislocations. A technique is outlined for growing large seeded zinc crystals of any desired orientation, and a method of acid machining gauge lengths in these crystals is described.

Cornell U., Ithaca, N. Y.
DENSITY MEASUREMENTS OF SOME THIN COPPER FILMS, by N. Wainfan, Nancy J. Scott and L. G. Parratt. Technical rept. no. 1 on Contract AF 49(638)402. 1 Dec 58, 21p. 12 refs. AFOSR-TN-58-1024; AD-162 289.
Order from LC mi$2.70, ph$4.80 PB 138 511

Density measurements on copper films, vacuum-deposited onto optically flat pyrex substrates, in the thickness range between 50 and 1000A. For a film thickness in excess of 120A the film density was found to be equal to the bulk density to within the limits of the experimental accuracy. Comparison of the x-ray method of measuring film thickness with an optical interference method.

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
FIELD EMISSION MICROSCOPY OF METAL CRYSTAL NUCLEATION, by K. L. Moazed and G. M. Pound. Final rept. on Oxidation, Vapor Nucleation and Surface Diffusion of Metals and Alloys, Contract AF 18(600)1572. 15 Sep 59, 114p. 56 refs. AFOSR-TR-59-131; AD-225 717.
Order from LC mi$6.00, ph$18.30 PB 143 829

A field emission microscopic investigation of the heterogeneous nucleation of metal vapors on metallic substrates. Nucleation of silver on tungsten was observed to occur when the population of adsorbed silver atoms reached a critical value at preferred sites on the substrate surface. Qualitative observations were also made on the evaporation and desorption of silver from a tungsten emitter tip.

Ferrous Metals

Curtiss-Wright Corp., Caldwell, N. J.
INVESTIGATION OF FATIGUE PROPERTIES AT ROOM TEMPERATURE OF HIGH STRENGTH STEELS HAVING HIGH TEMPERING TEMPERATURES, by Harold N. Cummings, Foster B. Stulen, and William C. Schulte. Rept. for 1 May 58-30 Apr 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5182. Sep 59, 105p. 8 refs. WADC Technical rept. 59-227.
Order from OTS $2.50 PB 161 144

High strength steels exhibiting some promise of good fatigue strength at temperatures up to about 1000°F were investigated. The tests reported herein were made at room temperature, as preliminary to later testing, under temperature, of the steels studied or modifications of them as suggested by the test results. Steels for (1) general structural use, (2) use for springs, (3) use for the surface of space vehicles, and (4) use for bearings, were investigated. Possibilities of improved fatigue performance were indicated provided the inclusion content could be lowered and the inclusion size restricted to below half a thousandth of an inch.

Engineering Materials Research Lab., Brown U., Providence, R. I.
ENERGY VERSUS STRESS THEORIES FOR COMBINED STRESS. A FATIGUE EXPERIMENT USING A ROTATING DISC [AND] BASIC RESEARCH ON FATIGUE FAILURES UNDER COMBINED STRESS, by W. N. Findley, P. N. Mathur and others. Technical rept. no. 7 (Final) on Contract DA 19-020-ORD-3520. Dec 58, 25p. 8 refs. EMRL-13.
Order from LC mi$2.70, ph$4.80 PB 143 069

An experiment in which the strain energy at the critical location for fatigue failure is maintained constant while the stresses on a given plane of the material at the same location are caused to fluctuate. Apparatus developed to produce this condition consisted of a circular disc with a wide-flanged rim which was loaded along a diameter by means of pivot-pad bearings. The disc was then rotated under a constant load.

Ingersoll Kalamazoo Div.; Borg-Warner Corp., Mich.
INVESTIGATION AND EVALUATION OF ULTRA STRENGTH STEEL FOR MISSILE BOOSTERS, by Arnold O. Moelk and R. A. Patterson. Rept. on Contract NOrd-15719. 10 Jan 58, declassified 17 Oct 58, 31p. 1 ref. Project rept. SPDIR-18; AD-155 241.
Order from LC mi$3.00, ph$6.30 PB 144 056

Three materials, SAE 4142, SAE 4340 and SAE 6140 were evaluated to determine the possibilities of

finding a material that has the potentialities of developing a yield strength of 240,000 psi in the heat treated condition. A material designated as MBMC #1 was developed.

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
CHEMICAL METHODS OF DETERMINING SULFUR IN LOW ALLOY AND CARBON STEELS, by Walter L. Miller. Final rept. 14 Aug 51, 28p. Lab. Proj. 4933-A-5.
Order from LC mi$2.70, ph$4.80 PB 143 905

As a part of the program for standardization of chemical test methods, seven Naval Laboratories have completed a collaborative test of two methods for determining sulfur in low alloy steels or carbon steels. The methods tested and the results are included. On the basis of results obtained and convenience of the method, a combustion-titration method was found to be the better method. This method has been rewritten in a form suitable as a standard method.

Minerals Research Lab., U. of California, Berkeley.
HIGH TEMPERATURE HEAT CONTENTS OF SOME BINARY IRON ALLOYS, by Weston B. Kendall, Raymond L. Orr, and Ralph Hultgren. Technical note no. 2 on Contract AF 49(638)83. 1 July 59, 16p. 3 refs. Series no. 137, issue no. 2; AFOSR-TN-59-524; AD-216 258.
Order from LC mi$2.40, ph$3.30 PB 143 672

Measurements of the heat capacity at elevated temperatures for ferrochromium, ferromanganese, ferrosilicon, and ferrocobalt alloys.

Naval Weapons Plant, Washington, D. C.
FLAME HARDENING OF MODULAR CAST IRONS, by F. A. Caudle and V. DePierre. 14 Aug 59, 28p. 55 refs. NAVORD rept. 6505; NWPW-T-16-59; AD-226 028.
Order from LC mi$2.70, ph$4.80 PB 143 886

A flame-hardening procedure consisting of multiple flame passes followed by water quenching is described for surface hardening ferritic nodular irons, MIL-I-17166, to a surface hardness of Rockwell C 50-58, with 0.03 to 0.07 inch case depths. A preliminary literature survey on flame hardening cast irons and laboratory tests used for establishing the flame-hardening procedure are reported.

Naval Weapons Plant, Washington, D. C.
NOTCH TOUGHNESS OF SPHEROIDAL GRAPHITIC HIGH DUCTILITY IRON CASTINGS, by Vincent DePierre and Shingo Inouye. 10 Sep 59, 51p. 24 refs. NWPW-T-3-59; NAVORD rept. 6493.
Order from OTS $1.50 PB 161 120

Data from a literature survey of notch toughness of spheroidal graphitic iron castings and test results obtained in the U. S. Naval Weapons Plant were used to show the effect of material variables and external test factors on the notch toughness of spheroidal graphitic cast iron. Material variables consist of chemical composition, microstructure, and susceptibility to temper brittleness. External factors cover test temperature, specimen dimensions, speed of loading, and stress concentration. An equation correlating the nil ductility temperature with material variables and external test factors was obtained for spheroidal graphitic cast iron from literature and test data.

Rock Island Arsenal Lab., Ill.
A COMPARISON OF PHOSPHATE COATINGS FOR USE IN THE COLD SHAPING OF STEEL, by D. R. Johnson. 4 Feb 58, 43p. 12 refs. Rept. no. 58-248; AD-204 335.
Order from LC mi$3.30, ph$7.80 PB 144 053

Coatings produced in the room temperature zinc phosphate solution were compared to those produced in the chlorate-nitrate and nitrate-nitrite accelerated zinc phosphate solutions. The room temperature zinc phosphate solution produced coatings whose draw characteristics were comparable to those produced in the chlorate-nitrate and the nitrate-nitrite accelerated solutions. Steel grit blasting was found to be slightly superior in draw properties to pickling as a pretreatment.

Watertown Arsenal Labs., Mass.
NOTCH TOUGHNESS OF DUCTILE CAST IRON AS A FUNCTION OF COMPOSITION, by S. V. Arnold. Dec 57, 19p. Technical rept. WAL TR 330/17; AD-149 956.
Order from LC mi$2.40, ph$3.30 PB 138 581

The compositions tested show the effect of individual alloying elements or specific combinations of elements upon mechanical properties. Silicon contents commensurate with maximum toughness in the as-cast and annealed conditions are 3.17% and 2.15% respectively. Maximum rupture energies for as-cast and annealed irons were 12 and 14 ft-lbs respectively.

Light Metals

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF TITANIUM-BASE ALLOYS FOR ELEVATED TEMPERATURE APPLICATION, by Frank A. Crossley, William F. Carew, and David W. Levinson. Rept. for 1 Jan 56-31 Mar 57 on Metallic Materials, Contract AF 33(616)2853. Nov 57, 66p. 6 refs. WADC Technical rept. 54-278, Pt. 4; AD-142 147.
Order from OTS $1.75 PB 131 593

Evaluation of 7Al-3Mo-Ti alloy: Studies of the effect of forging and heat treatment variations on the mechanical properties of this alloy met with several difficulties. Material used initially was discarded because of low ductility; this was attributed to the 0.2% oxygen content. Substitute material was also low in ductility for undetermined reasons. Significant conclusions were that (1) in heat treating, increasing

the solution treating temperature followed by water quenching increases the time required for overaging, (2) the Widmanstatten structure had about 10,000 psi greater rupture strength at 1000°F than the equiaxed structure, and (3) forged specimens had lower creep-rupture strength at 1000°F than machined specimens. Evaluation of 6Al-3Nb, 6Al-3Mo-2Ge, and 6Al-3Mo-4Ge Ti alloys: These alloys were evaluated by tensile, creep-rupture, and stability tests. Tensile properties were determined at room temperatures, 570°, 800°, and 1020°F. The 6Al-3Nb alloy was stronger than the 6Al-3Mo alloy at room temperature but had marginal ductility. Both Ge-bearing alloys were much stronger than the 6Al-3Mo alloy. The 6Al-3Mo-4Ge alloy had very low ductility. The 6Al-3Mo-2Ge alloy lost ductility in the stability tests. (See also PB 121 467)

Titanium Metallurgical Lab., Battelle Memorial Inst., Columbus, Ohio.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM: STATUS REPORT NO. 2, by C. R. Simcoe. 25 Sep 57, 52p. 30 refs. TML rept. no. 46B; AD-153 855.
Order from OTS $1.50 PB 121 630

The objectives of this research program were: (1) To determine the effect of forging and heat treatment variables on the mechanical properties of the Ti-7Al-3Mo alloy. Evaluations were made of tensile specimens, both machined from bar stock and cut from plate fabricated in such a manner as to simulate compressor blade forging practice. The purpose of this dual evaluation was to determine what effect the forged skin had on mechanical properties. (2) To determine the effect of sponge quality on mechanical properties of 7Al-3Mo alloys. (3) To evaluate the tensile, creep-rupture and stability properties of the alloys Ti-6Al-3Nb, Ti-6Al-3Mo-2Ge and Ti-6Al-3Mo-4Ge.

Watertown Arsenal Labs., Mass.
THE HOT HARDNESS OF TITANIUM AND TITANIUM ALLOYS, by F. R. Larson. July 58, 39p. 9 refs. Technical rept. WAL TR 401/300; AD-200 193.
Order from LC mi$3.00, ph$6.30 PB 138 582

Low alloy heats lose their hardnesses at a fairly high even rate. High alloy heats hold their hardnesses well up to about 1100°F, and then the hardness drops offf very sharply with increasing temperature. The influence of alloying elements in promoting resistance to softening was evaluated at 900°F. Iron was found to be the most effective with the other elements being arranged in order of decreasing effect, as follows: manganese, molybdenum, aluminum, zirconium, and chromium.

Structural Metallurgy and Corrosion

Aeronautical Materials Lab., Naval Air Material Center, Naval Air Experiment Station, Philadelphia, Pa.
THE EFFECTS OF NAPHTHENIC ACIDS ON THE CORROSION BEHAVIOR OF ALUMINUM ALLOYS IN FUEL TANKS, by H. Paige and S. J. Ketcham. Rept. for 17 Mar 50-10 Mar 51. 13 Apr 51, 30p. 5 refs. Rept. no. AML NAM AE411049, Pt. 1.
Order from LC mi$2.70, ph$4.80 PB 144 096

The effects of fuels on metals and alloys used in naval aircraft have been investigated by means of weight loss measurements after immersion in quiescent fuel samples and by means of corrosion studies of aluminum alloys exposed to aqueous extracts of the fuels in the presence of other metals. Total immersion tests indicate that the presence of up to 0.2% naphthenic acid in the fuels has no appreciable effect on any of the metals tested, with the exception of lead. In water extracts of the fuels, 52S aluminum alloy suffered consistent pitting corrosion when coupled to brass, copper or lead. Less severe pitting also occurred on uncoupled 52S aluminum alloy specimens in water extracts as well as in distilled water, when lead or copper were present under certain conditions. Small amounts of naphthenic acids in the water extracts possessed a tendency to decrease the corrosion reactions on aluminum alloys. This inhibiting effect was more pronounced in uncoupled tests and in water extracts of fuels containing toluene.

California Inst. of Tech., Pasadena.
CATHODIC PROTECTION IN CAVITATION DAMAGE: TESTS OF MILD STEEL IN A SALT SOLUTION, by M. S. Plesset, B. C. Bass and R. Hickling. Rept. on Contract Nonr-220(28). Nov 58, 26p. 11 refs Engineering Div. rept. no. 85-10.
Order from LC mi$2.70, ph$4.80 PB 143 619

Tests on mild steel specimens subjected to cavitation attack in a 3 per cent salt solution. Cathodic currents reduced the damage rate as the current level was increased. It seems reasonable to ascribe reduction in the cavitation damage to a cushioning effect by the hydrogen.

Curtiss-Wright Corp., Caldwell, N. J.
QUALITATIVE ASPECTS OF FATIGUE OF MATERIALS, by Harold N. Cummings. Rept. for 1 May 58-30 Apr 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5182. Sep 59, 263p. 323 refs. WADC Technical rept. 59-230.
Order from OTS $4.00 PB 161 145

This report discusses qualitatively the variables that affect the fatigue life and strength of structural metals. Although the table of contents purports to list variables separately, the text reveals the fact that many variables are themselves functions of other variables. This requires that extrapolation, from effects discussed under any set of circumstances to those that might occur under different circumstances, be done with extreme caution. Some of the theories of the mechanism of fatigue are discussed briefly at the end of the report.

Illinois Inst. of Tech., Chicago.
AN INVESTIGATION OF FATIGUE PHENOMENA IN METALS BY MEANS OF A RECRYSTALLIZATION TECHNIQUE, by J. L. Peterson and

N. H. Polakowski. Technical rept. no. 1 (Final) on Contract AF 18(603)68. Apr 59, 67p. 31 refs. AFOSR-TR-59-91; AD-220 924.
Order from LC mi$3.90, ph$10.80 PB 143 621

Experiments were conducted to determine the effect of combined static cold working and fatigue on the recrystallization behavior of several polycrystalline metals as indicated by the annealed grain size. A hypothesis based on possible polygonization and substructure formation in statically deformed metals under cyclic stress was advanced to account for the different effects of fatigue softening on mechanical properties on one hand and the recrystallization capacity on the other.

Naval Research Lab., Washington, D. C.
CORROSION OF METALS IN TROPICAL ENVIRONMENTS. PART 4. WROUGHT IRON, by C. R. Southwell, B. W. Forgeson, and A. L. Alexander. Interim rept. 13 Oct 59, 20p. 11 refs. NRL rept. 5370.
Order from OTS $0.50 PB 151 852

Aston-process wrought iron was exposed for eight years in the following environments: fresh and sea water continuous immersion, mean tide, and inland and marine atmospheres. In the underwater tests, wrought iron was most heavily corroded when continuously immersed in sea water. Only after eight years was the wrought iron weight loss in all three environments less than that for steel. When coupled with wrought iron, under specific conditions, corrosion of steel was reduced by about one-half. Exposure to the marine atmosphere resulted in 1.6 times more corrosion weight loss than the inland atmosphere. However, all four steels used were less heavily corroded than the wrought iron.

Naval Research Lab., Washington, D. C.
HYDROGEN-EMBRITTLEMENT SUSCEPTIBILITY OF SOME STEELS AND NONFERROUS ALLOYS, by J. E. Srawley. Final rept. 19 Oct 59, 28p. 12 refs. NRL rept. 5392.
Order from OTS $0.75 PB 151 937

A number of steels and nonferrous alloys have been tested to determine their comparative susceptibilities to hydrogen embrittlement. The criterion used was the ratio of the lowest nominal stress at which a hydrogen-charged notched tensile specimen fractured within 100 hours (the "static-fatigue limit") to the notched tensile strength of the uncharged material. Severe conditions of electrolytic charging were used (24 hours at 0.5 amp per square inch) so that a very slight degree of susceptibility might be detected. All steels examined, except cold-rolled AISI type 304 stainless steel, were susceptible in some degree. Hardenable steels harder than Rockwell C-30 were very susceptible, except AISI 1020, which was only moderately susceptible. AISI type 410 stainless was very susceptible at a hardness as low as Rockwell C-21. Of the nonferrous alloys examined, none showed marked susceptibility. It was found that beta brass was susceptible to delayed fracture under constant load, whether charged with hydrogen or not.

Northwestern U. [Evanston, Ill.]
CONTRIBUTION OF DISLOCATION LINE TENSION AND THE DENSITY OF THE SOLUTE ATMOSPHERE TO THE YIELD POINT IN STRAIN AGED INGOT IRON, by J. O. Brittain and T. Mura. Rept. on Contract AF 18(600)1598. 7 Aug 59, 25p. 11 refs. AFOSR-TN-59-760; AD-225 736
Order from LC mi$2.70, ph$4.80 PB 143 620

An investigation of the 77°K yielding behavior of ingot iron specimens that had been prestrained and aged while under stress at 303°K. The sharpness and magnitude of the yield point at both 303° and 77°K increased with an increase in the aging time and or an increase in the stress which was maintained upon the specimen during the aging treatment. The observations of the effect of the aging time and aging stress are discussed in terms of the contribution of the dislocation line tension and solute atmosphere density along the dislocation.

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by H. B. Whitehurst. Annual progress rept. no. 3, 15 Mar 57-15 Mar 58, on Contract NOrd-15764. [1958] 32p. 1 ref.
Order from LC mi$3.00, ph$6.30 PB 144 282

Process variables which can affect the tensile strength of glass-reinforced aluminum composites have been systematically investigated. Increasing the fluidity of the aluminum alloy resulted in better tensile strength.

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by H. B. Whitehurst. Quarterly progress rept. no. 10, 15 Mar-15 June 58, on Contract NOrd-15764. [1958] 26p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 144 283

The most promising method appeared to be an adaptation of some of the techniques which have proved successful for making powdered metal objects. Mixing the glass fibers uniformly throughout a bed of powdered metal, compressing the mixture to insure positive contact between the individual particles, and heat treating, or sintering, in order to achieve maximum strength and density. Sample bars were carried through the first two steps with powders of nickel, copper, stainless steel, chromium and brass; and either fused silica or the standard "E" composition glass. (See also PB 144 282)

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by H. B. Whitehurst. Quarterly progress rept. no. 11, 15 June-15 Sep 58, on Contract NOrd-15764. [1958] 30p. 2 refs.
Order from LC mi$2.70, ph$4.80 PB 144 281

Tests conducted using samples of powdered nickel, copper, stainless steel, chromium and brass reinforced with ceramic fibers to produce a high temperature analogue of glass fiber reinforced aluminum.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
TIN-ZINC ALLOY (72-28) ELECTRODEPOSITS, by E. MacNamara. Aug 58, 14p. 7 refs. Memo. rept. no. MR-685.
Order from LC mi$2.40, ph$3.30 PB 138 829

Electrodeposits of zinc, cadmium and tin-zinc (72-28) were made on low carbon, cold-rolled steel panels. With respect to corrosion resistance, the tin-zinc alloy was better than zinc, but not as good as cadmium. Solderability of the tin-zinc alloy was comparable to that obtained with zinc and cadmium, using 50-50 solder.

Watertown Arsenal Labs., Mass.
AN EVALUATION OF THE "SPATH METHOD" FOR PLOTTING FATIGUE TEST DATA, by Norbert H. Fahey. May 58, 22p. 3 refs. Technical rept. WAL TR 731/410; AD-158 459.
Order from LC mi$2.70, ph$4.80 PB 138 583

The resultant value for endurance limit, obtained by the "Spath Method" was found to be in error by as much as 12,000 psi or approximately 40% when compared with that obtained from the Wohler diagram. Although this method is quick and inexpensive to use, the results are not consistent enough to justify its use.

Watertown Arsenal Labs., Mass.
THE SPECTROPHOTOMETRIC DETERMINATION OF COPPER IN TITANIUM AND OTHER METALS WITH DICYCLOHEXANONE OXALYDIHYDRAZONE, by William K. Murray. May 58, 12p. 7 refs. Technical rept. WAL TR 401/299; AD-158 456.
Order from LC mi$2.40, ph$3.30 PB 138 591

Dicyclohexanone oxalyldihydrazone has been applied to the determination of copper in titanium alloys and other metals. This reagent reacts in alkaline solution with copper to form an intense blue colored complex which exhibits maximum absorption at a wave length of 600 mmu. The molar absorbancy of the complex is approximately 16,000. Other metals do not form colored complexes, thus allowing the direct determination of copper without extraction or preliminary separations. Ethanol stabilizes the complex in the presence of nickel, cobalt, and other metals.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
ANNUAL PROGRESS REPORT. Progress rept. no. 45, 1 June 56-31 May 57, on Contracts AT (30-1)-905 and Nonr-1841(16). [1957] 230p. 62 refs. AD-146 128.
Order from LC mi$9.90, ph$34.80 PB 144 104

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic and organic) groups
Cosmic ray group
High-energy accelerator project group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity, cyclotron, and theoretical groups
Cambridge electron accelerator project group
(See also PB 144 103)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
ANNUAL PROGRESS REPORT. Progress rept. no. 53, 1 June 57-31 May 58, on Contracts Nonr 1841(16), AT(30-1)-2098, and AF 49(638)181. [1958] 206p. 271 refs.
Order from LC mi$9.30, ph$31.80 PB 144 097

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
High-energy accelerator physics group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Theoretical group
Cambridge electron accelerator project group
(See also PB 144 101)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
FINAL REPORT OF RESEARCHES UNDER CONTRACT N5ori-07806 AND Nonr-1841(16). Rept. for 1 Apr 46-15 May 58. 15 May 58, 106p. 632 refs.
Order from LC mi$5.70, ph$16.80 PB 144 098

Contents:
Cosmic ray research
High energy nuclear physics; Introduction; 350 Mev M. I. T. synchrotron; Synchrotron research; Scattering of photons by protons, deuterons, and heavier nuclei; Review of photomeson experiments; Nuclear emulsion research; Bubble chamber research; Photo-nuclear research with the M. I. T. linear accelerator
Low energy nuclear physics; Research with the M. I. T. cyclotron; Research with the ONR generator; Research with the Rockefeller generator; Low energy scattering studies; Nucleon-nucleon scattering
Radioactivity research
Theoretical nuclear physics
Appendix A - List of degrees conferred by the Laboratory for Nuclear Science to students of physics from 1948 to 1958
Appendix B - Technical reports issued by the Laboratory for Nuclear Science from 1947 to 1958
Appendix C - Bibliography
(See also PB 144 097)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. nos. 42, 43, 1 June-30 Nov 56, on Contracts AT(30-1)-905 and Nonr-1841(16). 31 Aug 56, 30 Nov 56, 2 nos.
Order from LC

Progress rept. no. 42, 1 June-31 Aug 56, 87p. mi$4.80, ph$10.80, PB 144 099
Progress rept. no. 43, 1 Sep-30 Nov 56, 70p. mi$3.90, ph$10.80, PB 144 100

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. no. 44, 1 Dec 56-28 Feb 57, on Contracts AT(30-1)-905 and Nonr-1841(16). 28 Feb 58. 70p. 58 refs. AD-139 800.
Order from LC mi$3.90, ph$10.80 PB 144 103

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
Elementary particle scattering group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Synchrotron group
Theoretical group (See also PB 144 099)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. no. 50, 1 June-31 Aug 57, on Contracts AT(30-1)-905 and Nonr-1841(16). 31 Aug 57, 68p. 68 refs.
Order from LC mi$3.90, ph$10.80 PB 144 102

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
High energy accelerator physics group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Theoretical group
(See also PB 144 104)

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
PROGRESS REPORT. Rept. no. 52, 1 Dec 57-28 Feb 58, on Contracts AT (30-1)-905 and Nonr-1841(16). 28 Feb 58, 87p. 105 refs.
Order from LC mi$4.80, ph$13.80 PB 144 101

Contents:
Chemistry of the fission elements group
Nuclear chemistry (inorganic) group
Nuclear chemistry (organic) group
Cosmic ray group
High Energy accelerator physics group
Bubble chamber group
Linear accelerator group
Rockefeller generator group
ONR generator group
Radioactivity group
Cyclotron group
Theoretical group
(See also PB 144 102)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
PALLADIUM FILM FAST NEUTRON DETECTOR, by Ben R. Gossick. 8 Dec 49, 5p. 2 refs. NEPA 1228-ECR-6; AD-152 692.
Order from LC mi$1.80, ph$1.80 PB 138 455

Elementary Particles

California U., Los Angeles.
TECHNIQUES FOR CALCULATIONS OF FRACTIONAL PARENTAGE COEFFICIENTS AND NUCLEAR MATRIX ELEMENTS, by P. S. Kelly. Technical rept. no. 3 on Contract DA 04-495-ORD-913. June 59, 95p. 22 refs. OOR rept. no. 1784:6.
Order from LC mi$5.40, ph$15.30 PB 143 485

This paper has a dual purpose: (1) To provide sufficient background, references and explicative material to orient the reader in calculation of multiparticle matrix elements and wavefunctions; (2) To provide general and special case formulas for reference.

Maryland U., College Park.
K -NUCLEON SCATTERING LENGTHS AND THE K^--d INELASTIC CROSS SECTION, by T. B. Day and J. Sucher. Rept. on Contract AF 49(638)24. July 59, 8p. 10 refs. Physics Dept. Technical rept. no. 146; AFOSR-TN-59-819.
Order from LC mi$1.80, ph$1.80 PB 143 640

Maryland U., College Park.
K^--NUCLEON SCATTERING LENGTHS AND THE K^--d SCATTERING REACTIONS, by T. B. Day, G. A. Snow, and J. Sucher. Rept. on Contracts AF 49(638)24 and AT (40-1)2504. July 59, 17p. 14 refs. Physics Dept. Technical rept. no. 142; AFOSR-TN-59-772; AD-220 579.
Order from LC mi$2.40, ph$3.30 PB 144 038

The K^--d elastic and total cross sections are calculated, using a model which includes multiple scattering effects. The scattering lengths which Dalitz and Tuan [Phys. Rev. Lett. 2:425(1959)] find as fits to the K^--p data are used in an attempt to distinguish between the 4 possible solutions. The impulse approximation fails to give sensible results in this problem.

Stanford Research Inst., Menlo Park, Calif.
A FEASIBILITY STUDY: SCATTERING OF ELECTRONS BY IONS, ATOMS, AND MOLECULES, by Donald C. Lorents and Charles J. Cook. Scientific rept. no. 2 on Contract AF 19(604)3475. 17 Sep 59, 29p. 22 refs. AFCRC-TN-59-473; AD-226 316.
Order from LC mi$2.70, ph$4.80 PB 143 684

The experimental determination of electron differential scattering cross sections is considered in the light of recently developed experimental techniques. The techniques should be applicable to the study of a broad field of low energy electron interactions with atomic systems.

Nuclear Engineering and Power

Alco Products, Inc., Schenectady, N. Y.
CORROSION OF FUEL ELEMENTS MATERIALS FOR A LOW ENRICHMENT POWER REACTOR. Rept. on Contract DA 44-009-eng-2868. 1 Aug 56, declassified 3 July 57. 173p. APAE Memo. 44.
Order from LC mi$8.10, ep$28.80 PB 136 475

Alco Products, Inc., Schenectady, N. Y.
PREASSEMBLY AND TESTING STUDY OF AN APPR TYPE SYSTEM. Rept. on Contract DA 44-009-eng-3371. 31 Oct 57, 92p. APAE No. 22.
Order from LC mi$5.40, ph$15.30 PB 143 330

The primary objective of this study was the development of revisions in design, changes in equipment types, or changes in installation methods that will result in reduced overall costs, installation costs, and/or installation labor. These developments were primarily for the betterment of future APPR type plants. Where it is practical, the specific application of any improvements to APPR-1a was intended.

Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART 10. SOME REACTIVITY MEASUREMENTS, by K. W. Marlow, E. I. Nowstrup, and R. H. Vogt. Final rept. 21 Oct 59, 23p. 7 refs. NRL rept. 5389.
Order from OTS $0.75 PB 151 956

Reactivity measurements have been made on the modified swimming-pool nuclear reactor at the U. S. Naval Research Laboratory. The reactivity effect was measured for a change from a configuration with three sides of the core reflected by water and three sides reflected by graphite to a configuration with all sides water reflected. Other reactivity effects measured include those due to movement of beam-port plugs, adjustment of control and safety rods, addition and subtraction of fuel, power changes, exposure thimbles at the edge of the core, and cadmium and gold in the center of the core. (See also PB 151 058)

Nuclear Development Corp. of America, White Plains, N. Y.
A PROGRAM FOR THE DEVELOPMENT OF A FIELD EXPEDIENT SHIELD DESIGN MANUAL, by R. Schamberger. Rept. on Contract DA 44-192-eng-3, 6 Feb 59, 25p. 56 refs. NDA 2281-1.
Order from LC mi$2.70, ph$4.80 PB 143 116

In the design of field expedient secondary shields the radiation emitted by the reactor and primary shield combination must first be specified. It is shown that the reactors under consideration will emit a moderated fission neutron spectrum in addition to a variable gamma ray spectrum. The intensity of the neutron and gamma ray leakage, and the energy distribution of the gamma rays must be determined for each reactor.

Vitro Corp. of America, New York.
CONCEPTUAL DESIGN OF 2 Mw NUCLEAR HEATING PLANT, by F. Corio, R. Epstein, and J. E. Colgan. Rept. on Contract DA 44-009-eng-2861. 1 Nov 56 (Addendum 2 Jan 57) declassified 3 July 57. 218p. 31 refs. KLX-1768; KLX-1768A.
Order from LC mi$9.60, ph$33.30 PB 143 554

A conceptual design has been prepared for a nuclear heating plant to produce 7,300 lb/hr of steam at 150 psia and 358°F. This steam will supply a heat exchanger whose secondary steam is to be used for space heating and other low temperature applications. The thermal output of the reactor is 2,000 kw. The fuel plates consist of highly enriched (93.5%) uranium alloyed with an aluminum-nickel alloy and clad with aluminum-nickel alloy. Purified light water is used as the moderator and coolant. Boiling heat transfer is utilized. The reactor, when loaded with 6.84 kg of U-235, provides 2 Mw-yr of power before refueling. In order to reduce the reactivity excursion and facilitate control a burnable poison, in the form of boron, is incorporated in the fuel elements. The estimated capital investment, not including the uranium, is $675,800. The cost of operation is $267,620 per year of 15.3 mils/kw hr_h.

Radioactivity

Air Force Cambridge Research Center, Bedford, Mass.
ARTIFICIAL RADIOACTIVITY FROM NUCLEAR TESTS UP TO NOVEMBER 1958, by E. A. Martell. Sep 59, 22p. 31 refs. GRD Research notes no. 19; AFCRC-TN-59-444.
Order from OTS $0.75 PB 161 150

The production of fission products, carbon-14 and tritium in all United States, United Kingdom, and Soviet nuclear tests up to the end of 1958 is summarized and discussed. Major features of the atmospheric-mixing history and world-wide distribution of fallout are outlined. Some major differences between United States and Soviet tests are pointed out. Nuclear tracer experiments which will contribute to better understanding of atmospheric circulation and fallout are briefly described.

Convair, Fort Worth, Tex.
SPECTRAL AND ANGULAR DISTRIBUTIONS OF AIR SCATTERED Co^{60} GAMMA RAYS: SUPPLEMENT I, by B. S. Burton, Jr. Rept. on Contract AF 33(600)32054. 5 Mar 59, 14p. MR-N-168-1; NARF-59-10T.
Order from LC mi$2.40, ph$3.30 PB 142 900

This supplement presents all the raw data upon which MR-N-168 (PB 139 022) was based and gives certain corrections to be made to that report.

[Defense Atomic Support Agency] Washington, D. C.
GAMMA SPECTRA OF URANIUM-235 FISSION PRODUCTS AT VARIOUS TIMES AFTER FISSION, by P. J. Dolan. Mar 59, 75p. 6 refs. AFSWP-524.
Order from LC mi$4.50, ph$12.30 PB 144 105

Calculated gamma spectra produced by Uranium-235 fission are tabulated for various times after fission. Similar tabulations are given omitting certain volatiles and portions of their daughter products.

Lockheed Aircraft Corp., Marietta, Ga.
CONVERSION OF RADIATION DATA TO COMMON DENOMINATORS, by W. T. Harper. Rept. on Contract AF 33(600)32055. Oct 58, 28p. 3 refs. Nuclear rept. -45.
Order from LC mi$2.70, ph$4.80 PB 144 065

This report provides a detailed procedure with sample calculations for converting radiation data to units useful for comparing data obtained at different facilities. Gamma radiation data are converted to units of carbon gamma dose (erg g^{-1}), and neutron data are converted to water neutron dose (erg g^{-1}).

Naval Radiobiological Defense Lab., San Francisco, Calif.
A FALLOUT FORECASTING TECHNIQUE WITH RESULTS OBTAINED AT THE ENIWETOK PROVING GROUND, by E. A. Schuert. 3 Apr 57, 47p. 5 refs. Research and Development Technical rept. USNRDL-TR-139; AD-133 541.
Order from LC mi$3.30, ph$7.80 PB 144 150

A technique which was developed for rapid fallout forecasting not only satisfied the needs of the fallout program but also was accurate enough to allow a comparison between the meteorological aspects of model work and the results obtained from surface measurements. The technique is restricted to describing quantitatively the perimeter of the fallout, the axis of the hot line, and to determining the time of arrival of fallout throughout the pattern. No attempt was made to quantitate the expected levels of γ activity or to develop radiation contour lines. The method employs a simplified cloud model and distribution of particles in the cloud based on parameters which were obtained from previous weapons tests and from theory. The particles are tracked to the earth's surface by considering their falling speeds and effects of the winds existing aloft. Tracking is simplified by using a plotting device.

Naval Research Lab., Washington, D. C.
MEASUREMENTS OF THE AIR CONCENTRATION OF GROSS FISSION PRODUCT RADIOACTIVITY DURING THE IGY, JULY 57-DECEMBER 58, by L. B. Lockhart, Jr., R. L. Patterson, Jr., and W. L. Anderson. Interim rept. 18 Sep 59, 17p. 8 refs. Rept. 5359.
Order from LC mi$2.40, ph$3.30 PB 140 821

Measurements of the gross fission product radioactivity in the air at 21 sites along the 80th meridian and 4 sites in the North Pacific area are reported for the period July 1957-December 1958. The activity levels at the various sites are related both to the stratospheric deposition of nuclear debris and to the direct introduction of radioactive material into the troposphere upwind of the collecting sites. The fission product radioactivity of the air on the Northern Hemisphere increased markedly as the result of the extensive series of tests carried out during this period. Fission products, however, still contribute only a small fraction of the total radioactivity of the ground-level air. Radioactive debris injected into the troposphere at any particular site spreads rather rapidly throughout the same hemisphere but rarely crosses the equator in any quantity. An exception of this occurred during the Hardtack series in the Pacific when massive quantities of activity were transported to the Southern Hemisphere by winds in the upper troposphere. It is again shown that periods of heavy rainfall, such as occur during the rainy season in Panama, cause a general decrease in the concentration of fission products in the air.

Naval Research Lab., Washington, D. C.
RADIOCHEMICAL ANALYSES OF AIR-FILTER SAMPLES COLLECTED DURING 1958, by L. B. Lockhart, Jr., R. A. Baus and others. Interim rept. 23 Oct 59, 25p. 15 refs. NRL rept. 5390.
Order from LC mi$2.70, ph$4.80 PB 142 489

A number of radioisotopes formed in high-yield by nuclear explosions have been determined quantitatively in the gross fission product conglomerate collected by air filters at sites along the 80th meridian during 1958. This period of measurement is of particular interest since, during this time, the Soviet Union carried out two intensive test programs with high-yield weapons, primarily in the Arctic, and the United States carried out one such program at the Pacific Proving Grounds. Some of the debris from tests of the latter series were tagged with W^{185}, produced through the reaction W^{184} (n, γ) W^{185}. The presence of W^{185} in one case, and its absence in another, proved that debris from two nuclear tests of the Hardtack Series crossed that Equator. Save for the period of gross contamination in the troposphere by these debris, the average age of the fission product conglomerate in the air has been consistently older in the Southern than in the Northern Hemisphere. Furthermore, the Sr^{90} content of the air has shown a general pattern of maxima in the region between 20 and 40°N and 20 and 40°S latitudes and a minimum in the equatorial region. The maximum in the north, during early 1958, averaged about 7 times that in the south.

University of Southern California, Los Angeles.
SEMIANNUAL REPORT, by H. H. Forster. Rept. on Contract Nonr-1160(00). Dec 58, 3p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 143 931

Plans for the future are outlined. The previous experiments are designed for the purpose of measuring the relative magnitudes of the coupling constants in beta interactions and to test for time reversal invariance.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Human Resources Research Office, George Washington U., Washington, D. C.
THE EFFECTS OF WEARING THE CBR PROTECTIVE MASK UPON THE PERFORMANCE OF SELECTED INDIVIDUAL COMBAT SKILLS, by William E. Montague, Robert D. Baldwin, and Andrew H. McClure. June 59, 41p. Technical rept. 57.
Order from LC mi$3.30, ph$7.80 PB 143 538

One-Hour Effects of Masking. Wearing the protective mask tended to lower performance on all tests. The average masking losses ranged from 1 per cent on the test requiring detection of human targets by unaided vision and on one measure of firing shoulder weapons (rifle hits), up to 36 per cent for unaided voice communication at the 90-yard range. Five-Hour Effects of Masking. With one exception, all tests again showed mean differences indicating loss in performance due to masking. The average losses ranged from 2 per cent on the tests requiring detection of human targets by unaided vision and on radio communication, up to 41 per cent for unaided voice communication at the 90-yard range.

Naval Supply Research and Development Facility, Bayonne, N. J.
PROPERTIES AND POTENTIAL CLOTHING USES OF CELLULAR FORMS, by Lionel Weinstock. 23 Oct 59, 23p. 7 refs. Clothing and Textile Division rept. no. 34.
Order from OTS $0.75 PB 161 260

A cellular foam was first used in Navy cold weather clothing in 1942. This clothing was used by submariners early in World War II but was discontinued due to excessive weight and the shortage of rubber. Cellular foam elastomers, now available in a range of lower densities, were introduced in Western Europe and, more recently, in the United States as insulating materials for clothing. This report discusses the laboratory evaluation of three types, polyvinylchloride, neoprene and polyurethane, and notes the characteristics important to this end use.

Naval Supply Research and Development Facility, Bayonne, N. J.
SHIPBOARD EVALUATION OF EXPERIMENTAL WINTER FLIGHT DECK IDENTIFICATION CLOTHING, by Frank Merz, Jr. Rept. on Shipboard Combat and Occupational Clothing. 20 June 59, 12p. 4 refs. Research and Development rept. no. 32.
Order from LC mi$2.40, ph$3.30 PB 143 533

This identification garment, which represents a complete departure in design from the standard item, was evaluated on a comparative basis to determine whether visibility, functionability, and durability were improved. A description of the test and the results obtained are included in the report.

Quartermaster Research and Engineering Center, Natick, Mass.
WORLD GUIDE TO FIELD CLOTHING REQUIREMENTS, by Merle E. Sprague and Carl W. Ross. July 59, 44p. 57 refs. Technical rept. EP-115.
Order from LC mi$3.30, ph$7.80 PB 143 719

Present methods for determining the type and amount of clothing required for seasonal wear in a given world area are time-consuming, a more rapid method for obtaining such information has been developed and is presented in this Guide. The world has been classified into nine types of field clothing requirement areas. It has been determined that four distinct ensembles are required to protect troops adequately against all types of natural environments encountered in these nine areas. Maps and tables comprising the Guide (1) indicate the general amount of clothing required as protection against natural environmental conditions in all world areas, (2) prescribe the assortment of field clothing required for environmental protection in each place in each season, and (3) designate camouflage requirements for the issue of hot-weather assortments and overwhites.

PHYSICS

Army Chemical Warfare Labs., Army Chemical Center, Md.
STABILITY OF PYRIDINE-2-ALDOXIME METHIODIDE (2-PAM). I. MECHANISM OF BREAKDOWN IN AQUEOUS ALKALINE SOLUTION, by Robert I. Ellin. Oct 58, 15p. 10 refs. CWLR-2251; AD-207 511.
Order from LC mi$2.40, ph$3.30 PB 138 274

Pyridine-2-aldoxime methiodide (2-PAM, 2-formyl-1-methyl-pyridinium iodide oxime) has been found to be an effective chemical for overcoming the neuromuscular block that occurs in nerve gas poisoning. As part of a program leading to the development of a stable and effective therapeutic formulation of 2-PAM, the mechanism of the deterioration of 2-PAM in aqueous solutions of pH values ranging from 7 to 13 has been studied. The results given in this report show that at the indicated pH values 2-PAM breaks down to N-methyl-alpha-pyridone. A mechanism is given which suggests that the breakdown occurs in three steps: first, the formation of 2-cyanopyridine methiodide; second, the formation of 2-hydroxypyridine methiodide; and third, the

rearrangement of the latter to N-methyl-alpha-pyridone. The postulated mechanism may account for three observations made in this laboratory: (1) the presence of traces of cyanide ion in 2-PAM even after three recrystallizations from ethyl alcohol; (2) the presence of a green color in commercial preparations of 2-PAM, since N-methyl-alpha-pyridone turns green on exposure to light; and (3) the formation of two spots when commercial samples were chromatographed on paper.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
COMPARISON OF THE PAIR THEORY AND THE QUASI-PARTICLE METHOD FOR THE EVALUATION OF THE PROPERTIES OF AN INTERACTING BOSE SYSTEM, by J. Peretti. Rept. on Contract AF 18(600)1315. Aug 59, 15p. 5 refs. Technical note BN-182; AFOSR-TN-59-850.
Order from LC mi$2.40, ph$3.30 PB 143 153

We investigate the connection existing between the theories of Lee, Huang and Yang on one hand and of Boboliubov on the other for the interacting Bose systems. We perform the comparison in such a way that any physical quantity calculated in one of the two formalisms can be transcribed very easily in the other. This allows us in each case to evaluate any physical quantity with the formalism which seems the more appropriate for this purpose.

National Research Labs., Ottawa (Canada).
THE FREEZING AND MELTING TIMES OF SLABS AND CYLINDERS, by D. C. Baxter. Feb 59, 47p. 14 refs. Mechanical Engineering rept. MK-1.
Order from LC mi$3.30, ph$7.80 PB 142 878

General results for the time required to freeze or melt slabs or circular cylinders of a pure substance initially at the fusion temperature and exposed to a constant ambient temperature have been obtained on the PACE analogue computer. A six-lump model was used. The results for slabs agree with previously published results, while those for the cylinder with finite convection rates have not been available before.

Stanford Research Inst., Menlo Park, Calif.
EFFECTS OF NUCLEAR RADIATION ON MAGNETIC AND FERROELECTRIC MATERIALS AND QUARTZ: A LITERATURE SURVEY, by S. I. Taimuty. Scientific rept. no. 2 on Contract AF 19(604)4141. 28 July 59, 27p. 66 refs. AFCRC-TN-59-563.
Order from OTS $0.75 PB 161 115

Contents:
Ferroelectric materials
Magnetic materials
Quartz
  Optical properties
  Density and lattice constants
  Piezoelectric and dielectric properties
  Paramagnetism
  Thermal conductivity
Bibliography
(See also PB 138 723)

Acoustics

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
BIBLIOGRAPHY OF RESEARCH REPORTS AND PUBLICATIONS ISSUED BY THE BIO-ACOUSTICS BRANCH (1947-1957) by Anita Boes. Sep 57, 26p. 164 refs. AD-140 501.
Order from LC mi$2.70, ph$4.80 PB 143 944

This bibliography is a tabulation of publications considered to be of lasting interest as a result of research activities. The 164 references are listed under 12 subject headings pertaining to specific areas in physical and biological acoustics. Technical reports and notes, memorandum reports, and the more important journal publications are included.

California U., Los Angeles.
GRAZING INCIDENCE SOUND PROPAGATION OVER AN ABSORBING BOUNDARY, by Robert W. Lawhead. Technical rept. no. 2 on Contract N6onr-275(07). Feb 51, 121p. 33 refs.
Order from LC mi$6.30, ph$19.80 PB 143 104

California U., Los Angeles.
MOLECULAR ABSORPTION OF SOUND IN CARBON DIOXIDE, by Donald E. Chandler. Technical rept. no. 11 on Contract Nonr-233(48). May 58, 73p. 17 refs.
Order from LC mi$4.50, ph$12.30 PB 143 243

Very pure carbon dioxide was tested as well as the same gas with varying but accurately measured amounts of specified impurities. The apparatus is described and techniques are discussed. The equipment has been found to be an excellent apparatus for investigating the acoustical behaviour of highly absorptive gases in the temperature range from room temperature to 100° C and pressure ranges from a few millimeters of mercury to about one half of atmospheric, allowing measurement at any equivalent frequency (ratio of frequency to pressure) between 10 and 1000 kilocycles.

Electronics Research Lab., Northeastern U., Boston, Mass.
SPEECH ANALYSIS, by S. H. Chang, C. R. Howard and others. Final rept. on Contract AF 19(604)3465. 31 Aug 59, 71p. 18 refs. AFCRC-TR-59-187. AD-226 291
Order from LC mi$4.50, ph$12.30 PB 143 660

Chapter I describes several experiments designed to evaluate the importance of the Formoder parameters in the analog forms. Chapter II describes the performance of the Formoder when its parameters are time quantized and digitized by means of delta modulation. It is found that the articulation score on phonetically-balanced word lists averages nearly 70 percent for several male voices using only 1750 binits per second for the parametric transmission rate. Chapter III describes some recent instrumentation for the Formoder system. This includes a novel

R-C active filter for low frequencies, a plan for the digitization of the frequency parameters and the redesign of the Formoder synthesizer.

Navy Underwater Sound Reference Lab., Orlando, Fla.
DEVELOPMENT OF USRL TYPE J9 TRANSDUCER, by Claude C. Sims. 20 Mar 59, 16p. 4 refs.
USRL Research rept. no. 49; AD-219 716.
Order from LC mi$2.40, ph$3.30 PB 143 331

Underwater sound transducers for the audio-frequency range have always been unsatisfactory in many respects: They are heavy and large; they cover a narrow frequency range; they have unstable and irregular frequency responses; and they are difficult to repair. The reasons for these difficulties are discussed in this report, and a new transducer free of these difficulties is described. The new transducer, USRL type J9, has a smooth response at frequencies from about 40 cps to about 20 kc, it is small and lighweight, and it is easier to repair than earlier audio-frequency transducers.

Research Lab. of Heat Transfer in Electronics, Mass. Inst. of Tech., Cambridge.
THE EFFECT OF HIGH INTENSITY STATIONARY AND PROGRESSIVE SOUND FIELDS ON FREE CONVECTION FROM A HORIZONTAL CYLINDER, by R. M. Fand and J. Kaye. Rept. on Contract AF 33(616)3157. Mar 59, 138p. 62 refs. WADC Technical note 59-18; AD-209 532.
Order from OTS $2.75 PB 161 076

This study consists of an experimental investigation of the rate of convective heat transfer to air from a horizontal cylinder, 3/4" in diameter, under the following four different test conditions: free convection in the absence of sound; free convection with superposed plane stationary transverse sound fields, cylinder located at antinodes; free convection with superposed simple-harmonic plane stationary transverse sound fields, cylinder not at antinodes; and free convection with superposed simple-harmonic plane progressive transverse sound fields.

Electricity and Magnetism

California U., Los Angeles.
AN EXPERIMENT IN MAGNETOELASTICITY, by Robert A. Willett. Technical rept. no. 9 on Contract N6onr-275(07). July 57, 57p. 15 refs.
Order from LC mi$3.60, ph$9.30 PB 143 213

Ecole Nationale Supérieure de Chemie de Strasbourg (France).
CHEMICAL REACTIVITY NEAR CURIE POINTS, by H. Forestier. Final status rept. for 1 July 58-30 June 59 on Contract DA 91-508-EUC-395. [1959] 15p. 10 refs.
Order from LC mi$2.40, ph$3.30 PB 143 451

The chemical reactivity is discontinuous, not only near the ferromagnetic Curie point of an alloy, but besides near the Curie point of the pure ferromagnetic component (magnetogen component). The anomaly of reactivity near the Curie point of the magnetogen metal should be limited to primary solid solutions and connected with the possibility of ferromagnetism.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
MAGNETIC ANALYSIS OF THE PRECIPITATION OF IRON FROM BETA BRASS, by Ami E. Berkowitz and Philip J. Flanders. Rept. on Contract AF 49(638)159. Aug 59, 30p. 31 refs. Interim rept. I-A2026-2; AFOSR-TN-59-762; AD-226 492.
Order from LC mi$2.70, ph$4.80 PB 143 830

Single crystals of beta brass containing 0.07 weight percent iron were annealed at 300 and 400°C to precipitate the iron. Magnetic data were analyzed in terms of the concepts of fine particle ferromagnetism to derive size and shape distributions of the iron precipitate particles and the orientations of their crystallographic and shape symmetry axes.

Michigan State U. [East Lansing]
ELECTRICAL RESISTIVITY OF THIN METALLIC WIRES, by H. G. Satz. Rept. on Contract AF 49(638)70. 25 July 59, 49p. 26 refs. AFOSR-TN-59-639.
Order from LC mi$3.30, ph$7.80 PB 143 671

Measurements on thin indium wires at low temperatures have demonstrated that not only the residual but also the temperature dependent part of the resistivity increases as the wire diameter decreases. Electron-phonon scattering and Electron-electron scattering processes lead to a size and temperature dependent contribution to the total resistivity of thin wire.

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
ELECTROMECHANICAL EVALUATION OF MAGNETROSTRICTIVE CYLINDERS BY RESONANCE-ANTIRESONANCE MEASUREMENTS, by Ralph S. Wooliett. 15 Dec 53, 16p. 9 refs. USL Research rept. no. 225.
Order from LC mi$2.40, ph$3.30 PB 144 113

While the electromechanical coupling coefficient of piezoelectric crystals is commonly determined by measuring the resonant and antiresonant frequencies of the electrical impedance of the crystals, this method has had little use in evaluations of magnetostrictive material. To enable the advantages of this method to be exploited in magnetostrictive work, an analysis is presented in this report which shows the application of resonance-antiresonance measurements to magnetostrictive cylindrical-shell vibrators. Formulas are derived for the determination of the effective electromechanical coupling coefficient and mechanical Q, and the results are applied to the calculation of equivalent-circuit parameters. Dissipation is neglected in most of this analysis, but corrections are applied for leakage inductance. Formulas

are presented for determining fundamental material constants from data for short, thin cylinders, and a comparison of the resonance-antiresonance method with the impedance-circle method is made. The results of this analysis are particularly useful for the evaluation of magnetostrictive ferrites.

Swarthmore Coll., Pa.
TABLES OF THE INTERNAL MAGNETIC SOURCE FUNCTIONS U_n FOR THICK SOLENOIDS AND DISK COILS: n=3 TO n=17, TO COSINE ARGUMENTS, 8 TO 5 DECIMALS, WITH SECOND DIFFERENCES. WITH A SHORT TABLE OF THE EXTERNAL SOURCE FUNCTIONS W_n AND NUMERICAL EXAMPLES OF SOME APPLICATIONS OF THE FUNCTIONS, WITH NOTES, EQUATIONS, AND AUXILIARY TABLES, by Milan Wayne Garrett. Tables of U_n computed on UNIVAC by Joseph D. Rutledge, Milton D. Fisher and Winifred J. Goldberg (Remington Rand, Inc.) Rept. on Contract DA 36-034-ORD-594. Oct 53, 95p. 4 refs.
Order from LC mi$5.40, ph$15.30 PB 138 800

Westinghouse Electric Corp., East Pittsburgh, Pa.
PREPARATION OF MnBi BY REACTION OF FINELY DIVIDED POWDERS, by A. Goldman and G. I. Post. Rept. on Magnetic Phenomena of Matter, Contract AF 33(616)309. Mar 59, 26p. 12 refs. WADC technical note 59-205.
Order from OTS $0.75 PB 161 149

The process for producing manganese bismuthide by a low temperature reaction of manganese and bismuth powders has been studied with the purpose of obtaining reproducibly high purity MnBi. The most important factors in the preparation of the material were found to be the inertness of atmosphere, particle size, and state of agglomeration of reactants. A series of experiments showed that optimum size reduction could be obtained by ball milling, for at least 65 hours, a mixture of the elements which had previously been hammer milled. When packing occurred during ball milling, the cause was traced to the characteristics of the bismuth. If the particle size was small (~/u), the approach to reaction temperature could be quite rapid. Manganese-bismuthide of 90% purity was obtained with finely ground reactants. This material had a considerable amount of leeway in the type of reaction used in alloying and was reproducible. Tumbling the reactants while heating was not possible due to packing. Neither compression of the powders before reaction nor seeding it with MnBi appeared to improve the yield. Runs were tried with chemically precipitated bismuth, but explosion of the tubes always occurred.

Electronics

Antenna Lab., Calif. Inst. of Tech., Pasadena.
TRANSIENTS ON A LINEAR ANTENNA, by Georges G. Weill. Technical rept. no. 20 on Contract AF 18(600)1113. Aug 59, 15p. AFOSR-TN-59-791; AD-225 003.
Order from LC mi$2.40, ph$3.30 PB 143 158

Antenna Lab., Ohio State U. Research Foundation, Columbus.
CALCUATED PHASE VELOCITY OF LONG END-FIRE UNIFORM DIPOLE ARRAYS, by F. Serriocchioli and C. Lewis. Rept. on Contract DA 36-039-sc-70174. 13 Apr 59, 30p. 12 refs. Rept. 662-24.
Order from LC mi$2.70, ph$4.80 PB 143 353

Surface waves have been applied recently to the study of endfire arrays. An important step in the theory of surface-wave antennas is the calculation of the local phase velocity of the surface wave from the antenna geometry. While experimental work has been done along this line, no adequate theoretical solution seems to be available. In this report a mathematical procedure is presented for obtaining an approximate value of the phase velocity for long end-fire uniform dipole arrays, as a function of the antenna geometry. Results have been reported for a number of geometrical parameters and curves plotted to facilitate the analysis and design of arrays. The results have been compared with experimental measurements and an explanation has been given for the discrepancies found, and finally a criterion for correcting the results has been outlined.

Cruft Lab., Harvard U., Cambridge, Mass.
LINEAR ARRAYS: CURRENTS, IMPEDANCES AND FIELDS, I, by Ronald King. Scientific rept. no. 1, series 2, on Contract AF 19(604)4118. 1 May 59, 55p. 11 refs. AFCRC-TN-59-357; AD-217 409.
Order from LC mi$3.60, ph$9.30 PB 143 397

The radiation field of dipoles is usually expressed in the form of a product of a field factor and one or more arrays factors. Actually, such a formulation depends on the implicit assumption that the distributions of current along all elements are the same regardless of the location in the array or differences in driving conditions. Since this is a satisfactory approximation only when the elements are near a half-wavelength long, a study of the fields of arrays of longer elements in terms of the actual distributions of current is indicated.

Missouri U., Columbia.
ADIABATIC VS. BLOCH APPROXIMATION IN LATTICE SCATTERING OF ELECTRONS, by Bernard Goodman. Technical rept. no. 22 on Contract N7onr-292, T. O. 5. 15 Jan 58, 11p. 5 refs. AD-155 303.
Order from LC mi$2.40, ph$3.30 PB 138 279

The time dependence of an electron-phonon system described by means of Born-Oppenheimer states is shown to be the same to first order in the coupling as the usual Bloch theory.

Molecular Physics and Spectroscopy

Brown U., Providence, R. I.
THE INFRARED ABSORPTION SPECTRUM OF THE AMMONIUM ION IN LATTICES OF THE NaCl TYPE, by Willem Vedder. Rept. on Contract N6ori-88, T. O. 1. 1958, 91p. 140 refs; AD-162 484.
Order from LC mi$5.40, ph$15.30 PB 143 474

Carnegie Inst. of Tech., Pittsburgh, Pa.
RESEARCH IN THEORETICAL CHEMISTRY, by Robert G. Parr and Frank O. Ellison. Technical rept. for 1 Jan-31 Dec 57 on Theoretical Studies of the Electronic Structure of Diatomic and Simple Polyatomic Molecules, Contract DA 36-061-ORD-466; and Electronic Structure of Molecules, National Science Foundation Research Grant NSF-G3318. 1 Apr 58, 125p. 20 refs. AD-157 838.
Order from LC mi$6.30, ph$19.80 PB 143 839

A series of eight lectures given at Univ. of Chicago, June-July 1957. Also seven additional papers as follows: Special topics in the quantum theory of molecular electronic structure; On the diamagnetic anisotropy of benzene; A one-center wave function for the hydrogen molecule; The dipole moment of p-benzoquinone; On the nuclear magnetic shielding in the hydrogen molecule; Some extraordinary functions for improving calculations of electronic energies; and Improved simple analytical atomic wave functions.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
EMISSION OF DIFFUSE BANDS OF SODIUM BEHIND SHOCK FRONTS (I). MOLECULE FORMATION IN INERT GASES (II) by H. Takeyama and A. Guttman. Technical rept. no. 10 on Contract AF 18(603)02. Aug 59, 21p. 4 refs. AFOSR-TN-59-822; AD-225 671.
Order from LC mi$2.40, ph$3.30 PB 143 522

A diffuse emission band, centered near the resonance lines of sodium and attributed to van der Waals molecules Na_2, has been observed in a shock tube. A small quantity of finely-ground sodium salt (e.g., NaCl, NaBr or Na_2CO_3) was placed at the end of the low-pressure section of a shock tube containing an argon atmosphere. Spectra were recorded photographically with a 1.5 m grating spectrograph. Microwave absorption spectra on inert gases (He, Ne, A, Kr, Xe) or inert gas mixtures at low temperatures can probably be used to determine the interaction parameters required for the calculation of transport properties. This conclusion is reached from a study of predicted molecular spectra based on a determination of the Morse interaction potential through a second-order fit to the known Lennard-Jones potential.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
RELATIONS BETWEEN MOLECULAR GAS ABSORPTIVITIES AND EMISSIVITIES, by S. S. Penner, D. Olfe, and A. Thomson. Technical rept. no. 29 on Contract Nonr-220(03). Oct 58, 30p. 11 refs.
Order from LC mi$2.70, ph$4.80 PB 143 242

Theoretical expressions have been derived for the relations between gas absorptivities and emissivities for the limit of zero optical depth and for various models of vibration-rotation bands. Representative results for selected band models have been described elsewhere. The present research contains an exhaustive review and extension of the earlier work, with the limitation that the temperatures used for making the studies had to be sufficiently close to justify the assumption that neither the spectral line shape nor the band model are changed in character. Theoretical relations for important band models are derived. Correlations are developed to cover experimental data for CO_2, H_2O and CO and in terms of suitable theoretical expressions.

Institute of Optics, U. of Rochester, N. Y.
ULTRAVIOLET ABSORPTION IN THALLOUS HALIDES, by Simpei Tutihasi. Rept. on Contracts AF 49(638) (432, 433). July 59, 15p. 16 refs. AFOSR-TN-59-753.
Order from LC mi$2.40, ph$3.30 PB 143 635

The ultraviolet absorption in TlCl and TlBr has been measured on thin films and fused samples as a function of temperature. The effect of excessive chlorine or thallium on the optical absorption of TlCl has been studied. The experiments of Vysochanskii are discussed in the light of our observations. The first absorption band in TlCl, which peaks at 3.44 ev at -185° C, is absent in films condensed on a cold substrate of KCl and appears after annealing. It seems that the crystal structure of evaporated films of TlCl changes from the NaCl-type to the CsCl-type.

Instituto de Optica, Madrid (Spain).
INFRA-RED C=O BAND INTENSITY OF ACETIC ACID DERIVATIVES AND CHEMICAL ACTIVITY, by Jose R. Barcelo and Juana Bellanato. Final technical rept. no. 1, July 58-July 59, on Contract DA 91-508-EUC-357. [1959] 41p. 25 refs. AD-225 534.
Order from LC mi$3.30, ph$7.80 PB 143 452

The intrinsic intensity of the C=O infra-red band has been measured for various acetic acid derivatives, these measurements being carried out in carbon tetrachloride solutions of these substances. Twelve substances were studied, none of which were halogenated derivatives of acetic acid. All the chlorinated and fluorinated derivatives were studied and likewise two brominated and one iodinated derivative. For reference purposes, formic and acetic acids were studied. A deuterated compound was also studied -dichloroacetic acid with the carboxylic hydrogen substituted by deuterium. The method followed to measure the intensity was Wilson and Wells's and the correction used for the "wings" was that given by Ramsay.

Kansas State U., Manhattan.
THE SPECTRA OF NITROGEN OXIDES. I. THE SPECTRUM OF N_2O_4, by I. C. Hisatsune. Scientific rept. no. 1 on Contract AF 19(604)2255. [1959] 66p. 56 refs. AFCRC-TN-59-453.
Order from LC mi$3.90, ph$10.80 PB 143 667

A brief review of the structural and spectroscopic data on the known nitrogen oxides has been made in order to gain an overall picture of the present status of research on these molecules. A detailed discussion on N_2O_4, the first molecule investigated in this laboratory, is then given. This discussion includes results obtained from the experimental studies of the infrared spectra of the liquid and solid, the Raman spectra in the liquid and solid phases, the assignment of the spectra, the calculation of heat capacities and entropy of the solid, and the normal coordinate analysis using a modified valence force field. Experimental evidence showing the existence of isomers of N_2O_4 is also given.

Klyne, W.
OPTICAL ROTATORY DISPERSION OF ORGANIC COMPOUNDS, by W. Klyne. Final technical rept. no. 1, 1 May 58-30 Apr 59, on Contract DA 91-508-EUC-308. 25 May 59, 40p. 16 refs.
Order from LC mi$3.00, ph$6.30 PB 143 292

The general purpose of the work has been to explore the use for structural purpose of rotatory dispersion measurements on compounds which do not absorb light within the spectral range studied (600-280 mμ). The results show that much less information can be obtained from the rotatory dispersion of non-absorbing compounds than from that of absorbing compounds. However, the plain dispersion curve of a non-absorbing compound is worth more than a single point at one wave-length. No complex mathematical analysis of the curves has been carried out. Several different simple treatments of the data are considered. Much of the work has been concentrated on steroid alcohols and their derivatives. Results for these derivatives: (RR':C:N.NH.CO.NH_2) are generally disappointing.

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
MICROWAVE SPECTRUM, INTERNAL BARRIER, STRUCTURE, EQUILIBRIUM CONFIGURATION, AND DIPOLE MOMENT OF METHYL MONOFLUOROSILANE, by Louis Pierce. Rept. on Contract N5ori-1866, T. O. 14. [1957] 22p. 11 refs; AD-153 018.
Order from LC mi$2.70, ph$4.80 PB 138 448

The microwave spectrum of methylmonofluorosilane was investigated between 18 and 38 kmc. Several transitions of the isotopic species CH_3SiH_2F and CH_3SiD_2F were split into doublets because of coupling internal and over-all rotation; these splittings gave a barrier to internal rotation of 1559±30 cal/mol. The form of the potential barrier was assumed to be $V = 1/2V_3(1-\cos 3\alpha)$, where V_3 is the barrier height, and α is the angle which gives the relative orientation of the rotor and the framework. V_3 may be calculated in 2 ways. One method is to calculate a value of V_3 from each splitting; the results of such analysis are given for CH_3SiH_2F and CH_3SiD_2F. The over-all spread in V_3 for 9 transitions was 2%. An alternate method for determining V_3 is to adjust the rotational constants to give the best possible fit of the entire spectrum; the resulting values of Δa and Δb can be used to determine V_3. The observed and calculated transition frequencies and splitting for CH_3SiH_2F and CH_3SiD_2F are given. The best fit, was at V_3 =1562 and 1556 cal/mol for CH_3SiH_2F, and CH_3SiD_2F, respectively. The splittings in the excited state were constant with the barrier as determined from ground state observations. Rotational constants were also determined for $C^{13}H_3SiH_2F$, CD_3SiH_2F, and CH_3SiDHF.

Microwave Lab., Stanford U., Calif.
THE PARAMAGNETIC RESONANCE SPECTRUM IN SINGLE CRYSTALS OF BARIUM TITANATE, by John Edwin Maling. Technical rept. on Contract Nonr-225(18). Dec 58, 100p. 36 refs. ML Rept. no. 563.
Order from LC mi$5.40, ph$15.30 PB 143 841

Structure of barium titanate as a basis for understanding the symmetry analysis of the single-crystal paramagnetic resonance spectrum. Experimental and theoretical evidence is presented showing the presence of energy "gaps" in the energy-level system where crossings occur.

Missouri U., Columbia.
THERMOELECTRIC PROPERTIES OF POROUS SEMICONDUCTORS, by Eugene B. Hensley. Technical rept. no. 24 on Contract Nonr-2296(01). 1 Dec 58, 22p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 143 928

The properties of a class of porous semiconductors known as pore conductors are re-evaluated with regard to the possible application of these materials for thermoelectric power conversion. In general, the results appear very pessimistic as far as any prospect of high conversion efficiences are concerned.

Oslo U. (Norway).
INVESTIGATION OF MOLECULAR STRUCTURES, by O. Hassel. Technical scientific note no. 1 on Contract AF 61(052)71. 30 June 59, 41p. 10 refs. AFOSR-TN-59-916.
Order from LC mi$3.30, ph$7.80 PB 143 638

Contents:
Crystal structure of the addition compound 1,4-dioxan-chlorine.
Crystal structure of the addition compound benzene-chlorine (1:1).
Crystal structure of the addition compound 1,4-dioxan-sulphuric acid.
Charge transfer compounds with a halogen atom linked to carbon, halogen being the electron acceptor.
Crystal structure of the compound $CHI_3 \cdot 3$ Quinoline.
Crystal structure of the 1:1 addition compound formed by acetone and bromine.

Syracuse U., N. Y
EFFECT OF TEMPERATURE ON CARBONYL AND NITRILE STRETCHING FREQUENCIES IN SOLUTION, by E. Fishman and N. Krascella. Technical rept. on Contract AF 49(638)3. 1 July 59, 21p. 12 refs. AFOSR TN-59-660.
Order from LC mi$2.70, ph$4.80 PB 143 169

The present study of the effect of wide temperature variations on particular bond frequencies in solution was undertaken with the objective of seperating the effect of temperature dependent dipole-dipole interactions from other intermolecular forces causing frequency shifts. The results of the present investigation show that it is unlikely that any simple theory involving the physical properties of solvent and solute will have general applicability.

Technical U., Copenhagen (Denmark).
OPTICAL ROTATORY DISPERSION OF TRANSITION METAL COMPLEXES, by Flemming Woldbye. Final Technical rept. no. 1 for 1 Oct 57-31 May 59 on Contract DA 91-508-euc-246. 30 June 59, 64p. 37 refs.
Order from LC mi$3.90, ph$10.80 PB 143 117

A review of current theory observed leads to a set of criteria by which compounds for a fundamental study of optical activity may be selected. The octahedral complexes of the metals in the first transition group appear to be well suited to this purpose. The principle and the operation of the Keston Model D Polarimetric Unit by means of which most of the measurements reported herein have been performed are accounted for. The principle, construction and performance of a recording spectropolarimeter (based on the Cary MS-11 Recording Spectrophotometer) which has been developed in the course of this work are described in detail. A number of robust complexes have been prepared and resolution has been attempted. Solutions containing equilibrium complexes of Ni(II), Cu(II) and Co(II) with 1-pn have been shown to exhibit Cotton effect within their visible absorption bands. Absorption spectra and rotatory dispersion curves in the range 750-375 mμ of 16 different complexes of the two types are reported. A few theoretical comments on the rotatory dispersion curves are made and the absence of a pronounced solvent effect is demonstrated in the case of $[Co(tn)_3]^{+++}$.

Texas U. [Austin].
SPECTROSCOPIC EVIDENCE FOR LONG-RANGE REPULSIVE, INTERMOLECULAR FORCES, by W. W. Robertson and A. D. King, Jr. Rept. on Contract AF 49(638)35. [1959] 18p. 17 refs. AFOSR-TN-59-688.
Order from LC mi$2.40, ph$3.30 PB 143 021

Experimental results are presented on the shift of wave-length of absorption of benzene, naphthalene, pyrene and phenanthrene with density of the diluents helium and nitrogen. Arguments are presented to show that the blue shift observed in the benzene ^1L_b spectrum in helium are neither due to short-range repulsive forces nor to long-range dispersive forces. It is presumed that there are weak, long-ranged, non-dispersive forces present in the benzene-helium interaction that have the character of repulsive forces.

Optics

Centro di Studio per la Fisica Delle Microonde (Italy).
EXPERIMENTAL TEST ON A STEPPED ZONE MIRROR FOR MICROWAVES, by G. Toraldo di Francia, L. Ronchi, and V. Russo. Technical note no. 5 on Contract AF 61(052)67. Apr 59, 20p. 5 refs. AFCRC-TN-59-385.
Order from LC mi$2.40, ph$3.30 PB 143 790

Florida State U., Tallahassee.
AN EXPERIMENTAL STUDY OF X-RAY ATTENUATION COEFFICIENTS, 8-30 kev, by Richard D. Deslattes. Final rept. on Contract AF 18(603)64. 1958, 97p. 24 refs. AFOSR-TN-58-784; AD-202 009.
Order from LC mi$5.40, ph$15.30 PB 138 270

Precise values for the total attenuation coefficients have been obtained at approximately 1 kv. intervals from 8 to 30 kv. for 15 pure elements using a two-crystal spectrometer of high resolving power. These span the range of atomic numbers from 12 to 79. (Possibly disturbing effects of small-angle scattering were investigated.) The resulting values of μ for some elements may be assigned an average standard deviation of 0.2 percent.

Institute of Mathematical Sciences, New York U., N. Y.
ANNUAL SUMMARY REPORT. Rept. for 1 Dec 57-30 Nov 58 on Contract Nonr-285(25). [1958] 4p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 143 469

This report outlines the work done in exploring the exploitation of persistent internal polarization (p. i. p.) in phosphors for information storage. (See also PB 136 750)

Institute of Research, Lehigh U., Bethlehem, Pa.
USE OF WHITE LIGHT IN THE MEASUREMENT OF GAS DENSITY BY OPTICAL INTERFEROMETRY, by C. W. Curtis. Technical rept. no. 9 on Contract N7onr-39302. 15 Feb 58, 18p. 3 refs. AD-162 605.
Order from LC mi$2.40, ph$3.30 PB 138 254

The form of white light fringe patterns is derived for 2 symmetrical spectral distributions of intensity, and the effects of dispersion in the gas are computed. The shift of fringes through the maximum of the envelope of intensity for white light fringes is given in terms of coefficients in the Cauchy dispersion formula. Experiment verifies the applicability of the formula in nitrogen gas where the maximum intensity of a white light pattern is displaced about one fringe for a monochromatic (5460A) fringe shift of 15.

Laboratoire D'Infra Rouge Technique et Applique, Gif Sur Yvette (France).
CONSTRUCTION OF AN INFRA RED SOURCE OF HIGH LUMINANCE. Final technical rept. for May 58-May 59 on Contract DA 91-508-EUC-312. [1959] 22p. 3 refs; AD-225 643.
Order from LC mi$2.70, ph$4.80 PB 143 279

During the year 1958-1959 we have investigated the construction of a point source of radiation, with a modulated output and a high intensity in the far red and the near infra-red. The gun itself has been constructed with its focussing system enclosed in a vacuum-tight container, together with a motor which is also vacuum-tight. The conventional method for the preparation of luminescent screens has been modified to fit the particular case of cadmium sulphide. A large number of samples of copper, or silver, activated powders have been prepared.

Michigan U. Research Inst., Ann Arbor.
A SINGLE-CRYSTAL PHOTOCONDUCTIVE TELLURIUM DETECTOR, by G. Suits and P. Rice. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Feb 58, 10p. 4 refs. 2144-240-T.
Order from LC mi$1.80, ph$1.80 PB 138 802

The special properties of tellurium detectors make them appear particularly promising for the following applications: (1) Two-color infrared scanning systems, (2) Scanning systems using matched linear arrays of detectors, and (3) Infrared sensors which operate under conditions of high atmospheric attenutation.

[Physical] Research [Labs.] Boston U., Mass.
A COLLECTION OF GRAPHS CONCERNING ATMOSPHERIC TRANSMISSION, NATURAL ILLUMINATION AND REFLECTANCE OF TERRAIN. Rept. on Contracts W33-038-ac-14075 and AF 33(038)15615. 1 July 52, declassified 26 Sep 55, 52p. 34 refs. BUORL Technical note no. 87; AD-489.
Order from LC mi$3.60, ph$9.30 PB 144 265

Curves and a tabulation of their sources are given for microwave, IR, and visual-light transmission; reflectance of several materials, water vapor and zone concentrative; rainfall distributions; sky brightness; and spectral distributions.

Ramo-Woolridge, Los Angeles, Calif.
INFRARED BACKGROUND INVESTIGATION, by R. E. Eisele. Scientific rept. no. 1, 15 Mar 58-15 Apr 59, on Contract AF 19(604)3473. 30 June 59, 59p. 6 refs. C20-9U9; AFCRC-TN-59-843; AD-220027.
Order from LC mi$3.60, ph$9.30 PB 143 106

The contract was issued to measure the radiant intensity of the infrared sky background and to measure the amplitude of the frequencies distributed in the sky gradient. The data would be obtained through the use of an instrument known as the radiometer-gradient meter.

Syracuse U., N. Y.
WASHOUT EFFECT IN INFRARED BACKGROUND STUDIES, by W. R. Fredrickson, N. Ginsburg, and R. Paulson. Scientific rept. no. 1 on Contract AF 19(604)3908. June 59, 18p. 2 refs. AFCRC-TN-59-445, AD-220 724.
Order from LC mi$2.40, ph$3.30 PB 143 193

In the investigations of the spectral distribution of background radiation in the infrared, it was found that there was, in general, ready distinguishability between various objects at any one time. Such discrimination has been reported by us in a previous report and by the Ohio State group. It was found, however, that at certain times, this distinguishability disappeared. This effect is called washout. It has also been reported by various other investigators in the field, whose work is classified. In this report, the results of our efforts to determine the time and weather condition in which the washout effect might become apparent are given.

Solid State Physics

Armour Research Foundation, Chicago, Ill.
EFFECTS OF NUCLEAR RADIATION ON SOLID CATALYSTS, by Robert H. Bragg, Fred L. Morritz and others. Rept. for 15 June 58-30 Apr 59 on Contract AF 33(616)5896. June 59, 77p. 31 refs. WADC Technical rept. 59-286.
Order from OTS $2.00 PB 161 130

Both gamma ray and fast neutron irradiation causes changes in the electrical characteristics of single crystals and powders of zinc oxide. The two major effects of fast neutrons on single crystals are an enhanced conductivity when the irradiation is begun and a subsequent decrease as the irradiation is continued up to doses of 10^{15} nvt. Hydrogenation of ethylene occurs readily at 30°C over calcined zinc oxide powder, and a marked increase in activity is observed after further calcination in vacuo at temperatures up to 615°C. After irradiation to a dose of 10^{13} nvt the catalytic activity is decreased. In-pile experiments on the hydrogenation of ethylene over zinc oxide catalyst show that during irradiation the rate of the reaction is increased compared to the rate observed with the freshly calcined material without irradiation. Rather extensive irradiation experiments have been performed on mixtures of hydrogen and ethylene in the absence of a catalyst.

Armour Research Foundation, Chicago, Ill.
EXCESS NOISE IN SEMICONDUCTORS. Final rept. for 15 Nov 57-15 Nov 58 on Contract Nonr-1800(00). 10 Nov 58, 77p. 34 refs.
Order from LC mi$4.50, ph$12.30 PB 143 463

In a study of 1/f noise in single crystal silicon and germanium it is found that crystalline imperfections reduce the noise level. Naturally occurring

imperfections, those produced by plastic deformations and those generated by fast neutron bombardment all act in the same fashion. The results may be quantitatively explained by accounting for the decrease in minority carrier lifetime by crystalline imperfections. An experiment which allows an effective surface to volume change in the same sample has shown that surfaces dominate as the origin of 1/f noise. Using the field effect to alter occupancy of surface states it has been determined that the noise level decreases as the surface barrier is reduced. There is some evidence for a noise minimum when the surface fermi level matches that of the bulk, but this needs further confirmation. A search for critical fluctuations in solids has discovered the existence of such a phenomena at the curie point in single crystal $BaTiO_3$. Experiments on critical point fluctuations at the superconducting transition of single crystal tin are also in progress.

Armour Research Foundation, Chicago, Ill.
PRESSURE EFFECTS AND CONFIGURATION COORDINATE MODELS OF KCl(Tl) by L. Reiffel. Technical note no. 3 on Contract AF 49(638)113. 24 July 59, 8p. 9 refs. AFOSR-TN-59-761.
Order from LC mi$1.80, ph$1.80 PB 143 523

Since a straightforward extension of the Williams and Johnson configuration coordinate curves for the first excited state of KCl(Tl) coupled with their assumption of thermodynamic equilibrium requires very large changes in the emission ratio, these results do not lend support to their model. It appears that alternatives of the sort considered by Patterson and Klick and Knox may be better able to describe the actual situation. These latter suggestions can be arranged to predict small changes in intensity ratio due to pressure.

Brown U. Div. of Applied Mathematics, Providence, R. I.
SINGLE CRYSTAL PLASTICITY: A SURVEY. PART III. THEORIES OF PLASTIC DEFORMATION OF SINGLE CRYSTALS, by Robert C. Meacham. Rept. on Contract N7onr-358, T. O. 1. 15 Aug 48, 161p. 72 refs. A11 S-3, ATI-143 136.
Order from LC mi$7.80, ph$25.80 PB 144 287

Contents:
An estimate of the shear strength of a perfect single crystal
The Becker-Orowan theory of slip
A two-dimensional dislocation--edge type
Taylor theory of work hardening
The Burgers' combination of the Becker-Orowan and Taylor theories
Kochendörfer's contribution to the dislocation theory of plastic deformation
Further applications of the dislocation concept

California U., Los Angeles.
DIELECTRIC AND MAGNETIC PROPERTIES OF MATERIALS AT MICROWAVE FREQUENCIES, by W. D. Hershberger. Summary rept. for Dec 50-31 Dec 57 on Contract N6onr-27519. Apr 58, 5p. 20 refs. Dept. of Engineering rept. 58-31.
Order from LC mi$1.80, ph$1.80 PB 138 839

A summary including a list of technical papers.

Carnegie Inst. of Tech., Pittsburgh, Pa.
THEORY OF SHALLOW ACCEPTOR STATES IN SILICON AND GERMANIUM, by Daniel Schechter. Technical rept. no. 4 on Contract Nonr-760(13). 7 Mar 58, 137p. 48 refs. AD-207 307.
Order from LC mi$6.90, ph$21.30 PB 138 559

A qualitative discussion is presented of shallow impurity states in Si and Ge, with emphasis on the acceptor states. The experimental data concerning the bound acceptor states is summarized. The valence band structure in Si and Ge in the vicinity of the band maxima is reviewed. The derived effective mass equations have the form of a system of coupled equations, but due to the complexity of these equations exact solution was impossible for Si and Ge. The standard variation method for calculation of energy levels was followed. Trial functions were obtained for the ground state and the first 4 excited states using group theoretic considerations. The energies of these states were then calculated in the extreme limits of zero and infinite spin-orbit coupling. Corrections were made to these energy levels to take account of the actual spin-orbit coupling. When the results were compared with experiment, the agreement was found to be only qualitative. Possible reasons for this are discussed.

Colorado State U., Fort Collins.
STUDIES, RESEARCH AND INVESTIGATIONS OF THE OPTICAL PROPERTIES OF THIN FILMS OF METALS, SEMI-CONDUCTORS AND DIELECTRICS, by Lawrence N. Hadley, Jr. Final rept. for 16 Feb-13 Aug 58 on Contract DA 44-009-eng-3410. 13 Sep 58, 20p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 143 448

Cornell U., Ithaca, N. Y.
MICROWAVE STUDIES OF COLOR CENTERS IN BARIUM OXIDE, by J. W. Carson, D. F. Holcomb, and H. Ruchardt. Technical rept. no. 3 on Contract Nonr-401(15). 20 Nov 58, 19p. 16 refs: AD-207 203.
Order from LC mi$2.40, ph$3.30 PB 143 470

Electron spin resonance absorption measurements have been made at 9300 mc/sec on BaO crystals with excess barium. No spin resonance is observed which can be associated with the imperfection responsible for the optical absorption band at 2.0 ev. Large non-resonant microwave losses are also observed in the colored crystals. The present measurements are unable to distinguish between conduction in colloidal barium particles and electronic conduction in crystalline BaO itself as the source of the large losses.

Cornell U., Ithaca, N. Y.
SECONDARY POSITIVE ION EMISSION FROM METAL SURFACES, by Richard C. Bradley. Technical rept. no. 8 on Theoretical and Experimental Investigations of the Atomic Phenomena Occurring

on and near the Surfaces of Solids, Contract AF 18(600)674. 1 Sep 58, 33p. 11 refs. AFOSR-TN-58-642; AD-162 174.
Order from LC mi$3.00, ph$6.30 PB 138 503

Secondary positive ions ejected from surfaces of Mo, Ta, and Pt under bombardment by inert gas ions of low energy (< 1000 ev) have been studied in high vacuum ($\leq 10^{-8}$mm of Hg of background gases) using a mass spectrometer. Quantitative analyses based on abundance ratios of the ions are unreliable. Application of the technique to the investigation of surface kinetics seems highly promising.

Cornell U., Ithaca, N. Y.
THALLIUM TUNGSTEN BRONZE; A NEW DEFECT STRUCTURE, by M. J. Sienko. Rept. on Contract AF 49(638)191. 1 July 59, 21p. 7 refs. AFOSR-TN-59-504; AD-215 929.
Order from LC mi$2.70, ph$4.80 PB 143 000

Thallium tungsten bronzes, Tl_xWO_3, have been prepared ranging in composition from $x = 0.19$ to $x = 0.36$. Preparation methods included: (1) heating Tl_2WO_4, WO_3, and W; (2) vapor phase reaction of Tl and WO_3; (3) electrolysis of Tl_2CO_3 and WO_3 mixtures.

Diamond Ordnance Fuze Labs., Washington, D. C.
FREQUENCY SHIFT CAUSED BY FERRITE SPHERE IN A RECTANGULAR COAXIAL CAVITY, by John E. Tompkins. 20 Jan 58, 8p. 8 refs. TR-549.
Order from LC mi$1.80, ph$1.80 PB 138 894

A frequency-shift expression is obtained for a rectangular-coaxial cavity containing a small magnetized ferrite sphere, utilizing a method of characteristic impedance due to Magnus and Oberhettinger.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
EFFECT OF HEAVY DOPING ON THE DIFFUSION OF IMPURITIES IN SILICON, by Michael Francis Millea. Technical note no. 3 on Contract AF 49(638)417. 15 July 59, 50p. 27 refs. AFOSR-TN-59-460; AD-215 265.
Order from LC mi$3.30, ph$7.80 PB 143 673

The diffusivities of P, Sb, Sn and In in heavily doped n-type (5×10^{19} atoms/cm^3), and heavily doped p-type (2×10^{20} atoms/cm^3) silicon have been measured to obtain information on diffusion. The measured diffusivities of P and Sb in n-type are twice their values in intrinsic silicon; their diffusivities in p-type are one half those in intrinsic silicon. Possible diffusion mechanisms for substitutional impurities in silicon are discussed in the light of these and other data.

General Electric Research Lab., Schenectady, N. Y.
ION DRIFT IN AN N-P JUNCTION, by E. M. Pell. Scientific rept. no. 1 on Contract AF 19(604)5551. 14 Aug 59, 39p. 21 refs. AFCRC-TN-59-586. AD-225 984.
Order from LC mi$3.00, ph$6.30 PB 143 361

If a reverse bias is applied to an np junction at a sufficiently elevated temperature to give either the donor or the acceptor ions appreciable mobility, the ions will drift in the electric field of the junction to produce an intrinsic semiconductor region between the n and p regions. Such ion drift offers a simple and straightforward method for investigating diffusion constants, as well as chemical interactions within the host lattice which affect this diffusion. Preliminary results indicate its feasibility for measuring the diffusion constant of Li in Si to as low as 10^{-18} cm^2/sec and also for measuring the effect of Li-oxygen and Li-acceptor interactions in decreasing the diffusion rate.

Illinois U., Urbana.
PHOTOCONDUCTIVE HALL EFFECT IN SILVER BROMIDE, by Dwight C. Burnham. Rept. on Contract AF 18(600)662. June 59, 225p. 84 refs. AFOSR-TN-59-717; AD-226 402.
Order from LC mi$9.90, ph$34.80 PB 143 598

Using techniques developed by Kobayashi and Brown, the Hall mobility of electronic carriers in silver bromide was investigated in the low-temperature range. Other features of the transient photoconductivity of silver bromide were studied. Two of the samples used in the Hall effect studies were cut from an ingot purified by zone-refining techniques. Zone-refining procedures and results are described.

Illinois U., Urbana.
THE SELF ENERGY OF A HELICAL DISLOCATION, by Ronald de Wit, Doctoral thesis. Rept. on Contract Nonr-1834(12). Nov 58, 131p. 31 refs.
Order from LC mi$6.90, ph$21.30 PB 143 435

A review of dislocation theory is given, which includes Kröner's "continuum theory of dislocations and internal stresses." This theory leads to an energy expression for a dislocation in terms of a double line integral along the dislocation line. For the isotropic case this expression is used to find the self energy of straight, circular, cylindrical and helical dislocations. The connection with magnetostatics is pointed out. The helical dislocation is assumed to have a uniform shape with the Burgers vector along its axis. The axial length of the helix is large compared to its radius and the radius is large compared to the dislocation "cross section", which is of the order of a Burgers vector. For a helix of many turns and arbitrary pitch an expansion in a Fourier cosine series is used. The self energy is found in terms of elementary functions and Kapteyn series of Bessel functions.

Institute of Mathematical Sciences, New York U., N. Y.
ELECTROLYTIC CONTACTS FOR PHOTOCONDUCTIVITY MEASUREMENTS, by H. Kallman and M. Pope. Technical rept. on Contract Nonr-285(25). 4 Dec 58, 5p.
Order from LC mi$1.80, ph$1.80 PB 143 846

A cell was made which provided simultaneous electrical and optical access to an anthracene single crystal, facilitating photoconductivity studies. The cell

and electrolyte transmitted more than 90 per cent of the incident radiation at 3650 A. The results of A. C. and D. C. photoconductivity measurements made with this cell will be published in a forthcoming article.

Maryland U., College Park.
VIBRATIONAL THERMODYNAMIC PROPERTIES OF LATTICES WITH DEFECTS, by Jagadishwar Mahanty. Rept. on Contract AF 49(638)399. Aug 59, 100p. 34 refs. Dept. of Physics. Technical rept. no. 145; AFOSR-TN-59-758.
Order from LC mi$5.40, ph$15.30 PB 143 680

Techniques have been developed for evaluating the changes in the vibrational properties of a lattice due to the presence of defects, and they have been applied to the study of the effect of defects on some lattice models. Methods for extending the applicability of these techniques to the case of more complicated lattices are indicated and the discrete frequencies that arise due to an isotope defect in lattices with coupled displacement components are computed.

Massachusetts Inst. of Tech., Cambridge.
THE DUCTILE FRACTURE OF METALS, by Walter A. Backofen, Merrill L. Ebner, and Donald H. Avery. Technical rept. no. 7 on Contract Nonr-1841(25). 1 May 58, 61p. 20 refs; AD-161 847.
Order from LC mi$3.90, ph$10.80 PB 142 905

Contents:
Hardening characteristics of polycrystalline copper under fatigue loading
Fatigue in single crystals of copper
Electroshaping of copper single crystals

Massachusetts U., Amherst.
GEOMETRIC RELATIONSHIPS FOR X-RAY DIFFRACTION FROM ORIENTED FILMS OF POLYETHYLENE, by Richard S. Stein. Technical rept. no. 8 on Contract Nonr-2151(00). 13 Nov 58, 12p. AD-207 348.
Order from LC mi$2.40, ph$3.30 PB 143 475

An automatic x-ray diffractometer employing geiger counter or scintillation counter scanning has been constructed. The geometric relationships involved in determining the distribution of crystal orientations of polyethylene with this diffractometer are developed.

Microwave Lab. [Stanford U.] Calif.
PROPERTIES OF FERROELECTRIC CRYSTALS AT HIGH FREQUENCIES, by E. T. Jaynes. Final rept. for 1 Nov 54-31 Dec 58 on Contract Nonr-225(18). [1958] 3p. ML Rept. no. 565.
Order from LC mi$1.80, ph$1.80 PB 143 842

New York State Coll. of Ceramics, Alfred U.
PHOTOCONDUCTIVITY IN CADMIUM TELLURIDE, by Clyde Emerson McNeilly. Rept. on Contract Nonr-1503(01). July 58, 98p. 59 refs. AD-202 407.
Order from LC mi$5.40, ph$15.30 PB 144 263

Single crystals of cadmium telluride with an impurity concentration of about 10^{17} cc^{-3} have been prepared. Vacuum plated indium electrodes were used on n-type crystals while gold deposited from gold chloride solution was used on p-type. Thermal activation energy measurements indicate an intrinsic activation energy of 1.5 eV in the temperature range 350° - 20°C. The wavelength for maximum intrinsic photoconductivity is given by the expression:

$$\lambda(\bar{A}) = 8100 + 2.06\ T.$$

Pennsylvania State [U.] Mineral Industries Experiment Station [University Park].
HYDROTHERMAL CRYSTAL STUDIES, by Rustum Roy, R. C. DeVries and others. Rept. no. 4 for 1 July 51-30 June 52 on Contract DA 36-039-sc-5594. 15 July 52, 150p. 41 refs.
Order from LC mi$7.20, ph$22.80 PB 143 125

Studies on phase equilibrium in the systems $KF-MgF_2$ and $AgF-ZnF_2$, structural relations among the mixed oxides of the trivalent elements, and the crystal structure of $Y(OH)_3$ and $La(OH)_3$. Phase equilibrium studies in the system $K_2O-Al_2O_3-SiO_2-H_2O$ have been undertaken to define the pressure, temperature and composition limits for the synthesis of muscovite. (See also PB 140 448)

Pennsylvania State [U.] Mineral Industries Experiment Station [University Park].
INVESTIGATIONS CONCERNING SYNTHETIC LAYER LATTICE SILICATES. I. THE SERPENTINE-AMESITE JOIN IN THE SYSTEM $MgO-Al_2O_3-SiO_2-H_2O$ AND CLASSIFICATION OF THE CHLORITE MINERALS, by B. W. Nelson and Rustum Roy. Technical rept. no. 9 (Quarterly progress rept. no. 9), 1 July-30 Sep 53, on Hydrothermal Crystal Studies, Contract DA 36-039-sc-5594. 5 Oct 53, 79p. 45 refs.
Order from LC mi$4.50, ph$12.30 PB 143 128

The two-layer and four layer silicate structures are being studied with respect to limits of ionic substitution. The formation and stability of the brittle micas is also being studied. New areas of work include anion and cation substitution in the silica structures especially quartz, and the attempts to make more inverse, semi-inverse and partial semi-inverse perovskite structures. (See also PB 140 192)

Pennsylvania State [U]. Mineral Industries Experiment Station [University Park].
MULTIPLE ION SUBSTITUTION IN THE PEROVSKITE LATTICE [AND] PHASE EQUILIBRIA IN THE SYSTEM $BaTiO_3-CaTiO_3$, by Rustum Roy and R. C. DeVries. Technical rept. nos. 10-11 (Quarterly progress rept. no. 11) 1 Jan-31 Mar 54, on Hydrothermal Crystal Studies, Contract DA 36-039-sc-5594. 8 Apr 54, 53p. 15 refs.
Order from LC mi$3.60, ph$9.30 PB 143 127

A fairly large number of new oxide phases typified by such compositions as $KLaTi_2O_6$, Sr_2CrTaO_6, $Ba_3NiNb_2O_9$ and $BaKTiNbO_6$ have been synthesized

and shown to have the perovskite structure. Anion substitution successfully yields compounds with this structure only when it is complete - no mixed-anion perovskites were encountered. Very few perovskites with anions other than O^{2-} or F^- have been found. Phase equilibria in the system $BaTiO_3$-$CaTiO_3$ have been investigated by quenching, thermal analysis and pellet-melting methods. The system is characterized by extensive solid solution with a minimum at 17% $CaTiO_3$, 1585 ± 5°C. The extent of the hexagonal $BaTiO_3$ phase region toward $CaTiO_3$ is less than 1%. The temperature of the tetragonal-cubic $BaTiO_3$ inversion is lowered gradually by additions of $CaTiO_3$ to 88°C. Due to the small temperature range of the $BaTiO_3$ ss + liquid regions a wide range of compositions are satisfactory for crystal growing in this system.

Syracuse U. Research Inst., N. Y.
ELECTRON SPIN LATTICE RELAXATION IN PHOSPHORUS DOPED SILICON, by A. Honig and E. Stupp. Technical rept. no. 1 on Contract AF 18(603)50. 30 June 59, 48p. 18 refs. AFOSR TN-59-715.
Order from LC mi$3.30, ph$7.80 PB 143 023

Electron spin - lattice relaxation in phosphorus doped silicon has been investigated over a magnetic field range of 0 - 11,000 oersteds, a temperature range of 1.25°K. to 4.2°K. Three distinct relaxation mechanisms have been identified, and their functional dependence on magnetic field, temperature and concentration have been determined.

Uppsala U. (Sweden).
BORIDES AND SILICIDES OF THE PLATINUM METALS, by Bertil Aronsson, Jan Aselius and Erik Stenberg. Technical note no. 5 on Contract AF 61(052)40. 3 July 59, 6p. 7 refs. AFOSR TN-59-414; AD-214 561.
Order from LC mi$1.80, ph$1.80 PB 142 971

Three new structure types (tentatively notated as Ru_7B_3-, RhB- and IrB-1-2-types) are discussed briefly.

Uppsala U. (Sweden).
THE CRYSTAL STRUCTURE OF $SnCl_4.2SeOCl_2$, by Yngve Hermodsson. Technical note no. 6 on Contract AF [61](052)43. 20 Aug 59, 15p. 25 refs. AFOSR-TN-59-723.
Order from LC mi$2.40, ph$3.30 PB 143 636

The crystal structure of the addition compound $SnCl_4.2SeOCl_2$ has been determined and refined from three-dimensional X-ray data.

Uppsala U. (Sweden).
THE CRYSTAL STRUCTURE OF $(TiCl_4.POCl_3)_2$, by Carl-Ivar Branden and Ingvar Lindqvist. Technical note no. 7 on Contract AF 61(052)43. 20 Aug 59, 13p. 17 refs. AFOSR-TN-59-722; AD-226 387.
Order from LC mi$2.40, ph$3.30 PB 143 918

The crystal structure of $(TiCl_4.POCl_3)_2$ has been determined from three-dimensional X-ray data. The structure is built up of dimeric molecules $(TiCl_4.POCl_3)_2$ with double chlorine-bridges between the two titanium atoms of the dimer. The coordination around the titanium atom is octahedral. The oxygen atom in $POCl_3$ functions as donor atom. The approximately tetrahedral structure of $POCl_3$ is preserved. The nature of the acceptor-donor interaction in addition compounds where oxychlorides function as donor molecules is discussed.

Uppsala U. (Sweden).
AN X-RAY STUDY OF PHOSPHIDES OF THE PLATINUM METALS, by Stig Rundqvist. Technical note no. 7 on Contract AF 61(052)40. 29 July 59, 5p. 11 refs. AFOSR-TN-59-656.
Order from LC mi$1.80, ph$1.80 PB 143 919

The present author has started an X-ray powder and single-crystal investigation of phosphides of the platinum metals in order to establish the compositions of the phases and to determine the crystal structures. A preliminary report of the work is given.

Westinghouse Electric Corp., East Pittsburgh, Pa.
MAGNETO-OPTICAL EFFECTS IN FERROMAGNETIC OXIDES, by P. Bailey. Scientific rept. no. 1, 15 Mar-15 June 59, on Contract AF 19(604)5529. 15 June 59, 17p. 11 refs. AFCRC-TN-59-395; AD 225 169
Order from LC mi$2.40, ph$3.30 PB 143 629

The Faraday rotation exhibited by magnetized sections of yttrium and gadolinium iron garnets was measured in the wavelength range 1 - 15μ. Measurements made on α-Fe_2O_3 in the visible and near infra-red at room temperature indicated absorption peaks.

Willow Run Labs., U. of Michigan, Ann Arbor.
RESONANCE ABSORPTION OF PARAMAGNETIC IONS WITH SPIN 5/2: $CaCO_3$:Mn, by Chihiro Kikuchi. Technical memo. on Proj. Michigan, Contracts AF 49(638)68 and DA 36-039-sc-78801. Aug 59, 39p. 12 refs. 2616-10-R; AFOSR-TN-59-220; AD-211 802.
Order from LC mi$3.00, ph$6.30 PB 143 181

The theory of the paramagnetic resonance absorption of ions with S=5/2 in crystalline fields of trigonal symmetry is presented using manganous ions in calcite as an example. It is shown that the experimental results observed by Hurd, Sachs, and Hershberger can be accounted for by assuming that the manganous ions occupy the two nonequivalent Ca^{++} sites at random. Much of the theory presented here is also applicable to Al_2O_3:Fe, which is a potential material for a zero-field maser.

Theoretical Physics

Avco Research Lab., Everett, Mass.
THE PRODUCTION AND STUDY OF HIGH SPEED SHOCK WAVES IN A MAGNETIC ANNULAR SHOCK TUBE, by Richard M. Patrick. Rept. on Contract

AF 49(638)61. July 59, 42p. 15 refs. Research rept. 59, AFOSR-TN-59-845; AD-225 292.
Order from LC mi$3.30, ph$7.80 PB 143 155

A magnetic annular shock tube has been used to produce magnetically driven shock waves with very high velocities. Experiments were carried out with this device with two magnetic field configurations ahead of the shock front. The first configuration had a magnetic field ahead of the shock front in the direction of motion of the shock. In the second configuration the magnetic field ahead of the shock had its principal component in the plane of the shock front and a small component in the direction of motion of the shock. The continuum radiation emitted by the shock-heated plasma was measured with photomultipliers. The use of probes to measure the change in the local magnetic field in the shock front was investigated. With the second configuration shock velocities in excess of 4×10^7 cm/sec were measured in hydrogen. For these high speed shock waves, a shock thickness was obtained from measured rise times of the emitted visible radiation. These shock thicknesses are thinner than the mean free path in the shock-heated plasma, an observation which agrees with a theoretical prediction.

Avco Research Lab., Everett, Mass.
THEORY OF THE FLOW IN THE MAGNETIC ANNULAR SHOCK TUBE, by Nelson H. Kemp and Harry E. Petschek. Rept. on Contract AF 49(638)61. July 59, 37p. 7 refs. Research rept. 60; AFOSR-TN-59-846; AD-225 774.
Order from LC mi$3.00, ph$6.30 PB 143 521

This paper gives a theoretical description of the properties of the gas flow in the magnetic annular shock tube. This shock tube uses a magnetic field to drive a shock wave through an annular region, producing a very high temperature plasma. It is shown that this particular configuration allows a fairly precise calculation of the flow parameters. Numerical calculations of the significant flow properties for a complete range of the initial field strength and orientation have been made and are presented graphically.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE WAVE MOTIONS OF SMALL AMPLITUDE IN RADIATION-ELECTRO-MAGNETO-GAS DYNAMICS, by S. I. Pai and A. I. Speth. Rept. on Contract AF 49(638)401. July 59, 23p. 8 refs. Technical note BN-180; AFOSR-TN-59-879; AD-225 691.
Order from LC mi$2.70, ph$4.80 PB 143 387

The fundamental equations of radiation-electro-magneto-gas dynamics are first discussed. These equations are linearized under the condition there exists an externally applied uniform magnetic field. Wave motions of infinitesimal amplitude which may be divided into a transverse wave and a longitudinal wave, are analyzed. Radiation phenomena exert influence only on the longitudinal wave while the transverse wave is independent of the radiation field. The radiation effect is characterized by introducing a radiation parameter which is the ratio of radiation pressure to the gasdynamic pressure. For ideal plasma, it may be expressed in terms of an effective radiation sound speed. Various simple cases of this wave motion of small amplitude in radiation electro-magneto-gas dynamics have been discussed. The condition where the radiation effect becomes important is also discussed.

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
IMPROVED MICROWAVE TECHNIQUES FOR MEASURING PLASMA PARAMETERS, by Jaan Kannelaud and Romayne F. Whitmer. Scientific rept. no. 1 on Investigation of Non-Linear Phenomena Associated with Ionized Plasmas, Contract AF 19(604)4083. 22 July 59, 39p. 9 refs. AFCRC-TN-59-578, AD-225 405.
Order from LC mi$3.00, ph$6.30 PB 143 494

A study is made of microwave methods for performing measurements of plasma characteristics. A discussion is given of the assumptions made in the theoretical analysis and of means for satisfying these conditions experimentally. An experimental arrangement was designed and tested in an attempt to determine the relative importance of experimentally satisfying the various assumptions. It was found that the phase shift measurements (which yield the electron density in the plasma) were relatively insensitive to many of the analytical conditions. However, the plane wave--infinite medium assumption imposes serious restrictions on the manner in which attenuation measurements (which yield the electron-neutral particle collision frequency) are performed.

Rome Air Development Center, Griffiss AFB, N. Y.
THE STATUS OF MICROWAVE PLASMA PHYSICS, by Daniel J. Kenneally. Summary rept. Aug 59, 34p. 105 refs. RADC-TN-59-200; AD-217 680.
Order from LC mi$3.00, ph$6.30 PB 143 907

An attempt is made to determine the present status of those aspects of plasma physics which are mainly concerned with the interaction of microwave signals with plasma media. The basic equations are presented. Typical methods of plasma generation and shock simulation are presented. Certain recommendations are shown to be appropriate with respect to facilities and technical manpower presently available. In particular, the study and exploitation of hot plasma interactions is shown to be worthy of further effort. In addition, a cold plasma as a microwave network element is shown to be an extremely desirable and technically feasible area for unique exploitations.

Thermodynamics

Air Force Missile Development Center, Holloman AFB, N. Mex.
CALCULATION OF THE CONCENTRATION OF THE SOLAR RADIATION THROUGH THE FOCAL SPOT OF A PARABOLIC MIRROR ON THE BASIS OF A

NON-UNIFORM SUN, by Alfred W. Simon. Sep 59, 17p. 5 refs. AFMDC TN-59-23.
Order from LC mi$2.40, ph$3.30 PB 143 186

The concentration of energy through the focal spot of a parabolic mirror is calculated on the basis of data given by Abetti on the variation of intensity across the face of the image of the solar disc as a function of the radius of the point considered. The result is 66,078 cal/cm^2/minute on the basis of a value of the solar constant of 1.76 cal/cm^2/minute. The value agrees closely with that of Jose obtained on the basis of an empirical formula.

Air Force Missile Development Center, Holloman AFB, N. Mex.
SOLAR FURNACE SUPPORT STUDIES, VOLUME II. 1959, 292p. 38 refs. AFMDC-TR-59-15; AD-213 260.
Order from LC mi$11.10, ph$44.10 PB 143 633

Contents:
Design of a solar furnace and the calculation of concentration using spherical-mirror elements
Aerodynamic stability of a heliostat structure
Oscillations of a rigid heliostat mirror caused by fluctuating wind
Studies on thermal effects on solar furnace mirrors
A radiation fluxmeter for high intensity applications
Instrumentation for the 108-foot diameter cloudcroft solar furnace
The proof of certain laws of optics used in solar furnace calculations
The design of a heliostat mirror for a solar furnace
The design of the condenser of a solar furnace using non-parabolic elements
The flux through a focal spot of a solar furnace
Calculation of the concentration of energy at points outside the focal spot of a parabolic condenser

Armour Research Foundation, Chicago, Ill.
THE MECHANICAL PROTECTION OF THE W/Ir THERMOCOUPLE, by Gary Steven and Walter C. Troy. Rept. no. 21. 13 Aug-5 Sep 49. 9 Sep 49, 11p. NEPA 1153-ARM-22; AD-206 714.
Order from LC mi$2.40, ph$3.30 PB 138 456

The installation of a gas-fired muffle furnace was completed. Constructional details as well as data on the furnace operation are included in this report. The performance of the furnace was checked during a 12-hour run at a temperature of 1950° to 1980°C. During this high temperature run, an unprotected Ir/60% Rh, 40% Ir thermocouple was operated satisfactorily inside the furnace muffle.

Arnold Engineering Development Center [Tullahoma, Tenn.]
A METHOD OF FORMING CONTINUOUS EMPIRICAL EQUATIONS FOR THE THERMODYNAMIC PROPERTIES OF AIR FROM AMBIENT TEMPERATURES TO 15,000°K, WITH APPLICATIONS, by Martin Grabau. Rept. on ARO, Inc. Contract AF 40(600)800. Aug 59, 37p. 7 refs. AEDC-TN-59-102.
Order from LC mi$3.00, ph$6.30 PB 143 920

This work relates generally to automatic data reduction for arcdriven, hotshot-type wind tunnels which operate at high stagnation temperatures. Pressure and density are used as the simplest independent variables.

Brown U. Div. of Engineering, Providence, R. I.
THE ELECTROPLASTIC THICK-WALLED SPHERE SUBJECTED TO RISING TEMPERATURE GRADIENTS, by G. R. Cowper. Technical rept. no. 9 on Contract Nonr-562(20). Nov 58, 30p. 8 refs. Nonr-562(20)9; AD-207 361.
Order from LC mi$2.70, ph$4.80 PB 143 412

An exact solution is obtained for the behavior of an ideal elastoplastic hollow sphere subjected to a monotonically increasing temperature gradient. An approximate rigid-plastic solution is also developed and compared with the exact solution. A technique for improving the approximate solution is indicated. Finally, the extension of the analysis to the case in which yield stress depends on temperature is discussed.

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC DATA BOOK, by Dudley B. Chelton and Douglas B. Mann. Mar 59, 155p. WADC Technical rept. 59-8; AD-208 155.
Order from OTS $3.00 PB 151 837

A compilation of the physical properties of several liquefied gases and a number of structural and thermal insulating materials in the temperature region of liquefied gases are presented. Specifically, the liquefied gases treated are helium, hydrogen (para and ortho), hydrogen deuterids, deuterium, nitrogen, oxygen and air. The data is presented in the English system of units.

Diamond Ordnance Fuze Labs., Washington, D. C.
THE THERMAL CONDUCTIVITY OF SOLIDS AT HIGH TEMPERATURES: A BIBLIOGRAPHY, by W. T. K. Johnson. 1 June 59, 71p. 474 refs. TM-59-4.
Order from OTS $2.00 PB 161 118

A total of 474 references is given. Most of the references since 1940 are accompanied by a brief description of content. This information has been compiled in connection with studies on thermoelectric generators.

Electrical Engineering Research Lab., U. of Texas [Austin].
APPARENT TEMPERATURES OF SOME TERRESTRIAL MATERIALS AND THE SUN AT 4.3 MILLIMETER WAVELENGTHS, by C. W. Tolbert, C. O. Britt, and A. W. Straiton. Rept. on Contract Nonr-375(01). 1 July 57, 37p. 6 refs. Rept. no. 93.
Order from LC mi$3.00, ph$6.30 PB 138 960

This report describes the 4.3 millimeter radiometer and its operational characteristics, the temperature of various terrestrial materials, the attenuation through the atmosphere and the temperature of the sun. The

temperatures of the terrestrial materials were measured for vertical and horizontal polarization over an angular range from normal incidence to near grazing. The attenuation vertically through the atmosphere ranged between 1.6 and 2.3 decibels during the measurement program. The sun of optical disk size was found to be between 10^4 and 1.2×10^4 degree Kelvin on May 3 and June 17 of 1957. Since the apparent temperature of the materials measured is dependent upon their reflectivity, a measure of the reflecting characteristics of water, wood, metal, grass, asphalt, gravel and asbestos at 4.3 millimeter wavelengths was obtained.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DEVELOPMENT OF THERMOCOUPLES FOR USE ON THERMOELECTRIC GENERATORS. Final rept. for 30 Apr 47-30 Sep 50 on Contract W36-039-sc-33654. [1950] 48p. Rept. no. F-1992-13; ATI-89 883.
Order from LC mi$3.30, ph$7.80 PB 144 088

The development of Zn-Sb alloys, properties of PbS, and the design and construction of an experimental thermoelectric generator. Thermoelectric properties have been investigated most thoroughly for PbS and the intermetallic compound Zn-Sb.

Illinois U. [Urbana].
A GENERAL INVESTIGATION OF THERMAL STRESSES IN SHELLS, by H. L. Langhaar and A. P. Boresi. Technical rept. no. 1 on Contract Nonr-1834(14). Oct 57, 63p. 14 refs. T & AM rept. no. 124.
Order from LC mi$3.90, ph$10.80 PB 138 898

A general theory of thermal stresses in shells is developed. The equations for small deflections of any shell are generalized to include the effects of a temperature distribution that is an arbitrary function of the curvilinear coordinates (x, y, z) of the shell. Additionally, the strain energy expression for any elastic isotropic shell is developed for an arbitrary temperature distribution.

Institute of Flight Structures, Columbia U., New York.
UPPER BOUNDS AND SAINT-VENANT'S PRINCIPLE IN TRANSIENT HEAT CONDUCTION, by Bruno A. Boley. Technical rept. no. 13 on Contract Nonr-226(20). Dec 58, 8p. 7 refs. CU-13-58-ONR266(20)-CE.
Order from LC mi$1.80, ph$1.80 PB 143 608

An investigation is carried out on transient heat-conduction problems with prescribed surface temperature, and the validity of Saint-Venant's principle in parabolic boundary-value problems is discussed.

James Forrestal Research Center, Princeton, N. J.
THERMAL CONDUCTION IN LIQUIDS, by William J. Scheffy. Rept. on Contract Nonr-1858(25). Oct 58, 105p. 86 refs. Proj. Squid Technical rept. PR-85-R.
Order from LC mi$5.70, ph$16.80 PB 143 293

A study of heat conduction in pure liquids has been undertaken from the point of view that the primary problem is that of prediction of the thermal conductivity of a liquid at any conditions which may happen to be of interest to the engineer. The experimental, empirical approach has been taken, since the more rigorous theories of liquids are not yet of practical value for liquids more complex than argon. Prediction must be based on measured values for a variety of polyatomic liquids. An apparatus was constructed to measure the thermal conductivities of liquids over a wide temperature range. The various simplified theoretical approaches are discussed and the prediction equations to which they lead are criticized. Recommendations are made regarding the calculation of thermal conductivity at temperatures near the critical.

Little, Arthur D., Inc., Cambridge, Mass.
THE IGNITION OF GASES BY ELECTRICALLY HEATED WIRES, PART I, by Leland E. Ashman and William E. Gordon. Rept. on Contract AF 18(603)109. 19 Jan 58, 23p. 2 refs. AFOSR-TN-58-1010; AD-206 153.
Order from LC mi$2.70, ph$4.80 PB 143 595

If a 1-1/2-cm length of 2-mil tungsten wire is heated in a period of about 100 microseconds, such as by the discharge of a condenser, at the end of the heating period, the temperature distribution along the wire is essentially flat. This fact is used in the investigation of the ignition of gases by electrically heated wires. Since the temperature distribution is flat, the current to maintain the center of the wire at a constant temperature is a measure of the heat flux from the wire to the gas. A theoretical analysis of the heat flow shows that the temperature of the center of the wire is independent of end losses for about 100 milliseconds. A general formulation of the problem is applicable to wires of any length and diameter.

Little, Arthur D., Inc., Cambridge, Mass.
THE IGNITION OF GASES BY ELECTRICALLY HEATED WIRES, PART TWO, by Leland E. Ashman and William E. Gordon. Rept. on Contract AF 18(603)109. 19 Jan 58, 24p. 17 refs. AFOSR-TN-58-1011; AD-206 154.
Order from LC mi$2.70, ph$4.80 PB 143 594

Experimental studies have been conducted on the ignition of gases with constant temperature wire ignition sources. Some effects of wire size, wire composition, and gas pressure on the ignition delay have been investigated for the case of the hydrogen-air mixture. For a given wire temperature, the ignition delay increases when either the diameter of the wire or the gas pressure is reduced. The magnitude of this reduction in ignition delay agrees, at least to a first approximation, with theoretical considerations of the effect of wire size and gas pressure on ignition delay. (See also PB 143 595)

Massachusetts Inst. of Tech., Cambridge.
HEAT TRANSFER IN DISSOCIATED COMBUSTION GASES, by John C. Cutting, James A. Fay and others Rept. on Contract AF 49(638)375. July 59, 49p. 25 refs. AFOSR-TR-59-78.
Order from LC mi$3.30, ph$7.80 PB 143 150

This report outlines a series of experiments and theoretical calculations performed to determine the rate of heat transfer from gases in detonation waves.

Minerals Research Lab., U. of California, Berkeley.
ARC IMAGE FURNACE, by D. O. Horning and Earl R. Parker. Final rept. on Contract AF 18(603)123. May 59, 30p. 28 refs. Series 141; AFOSR-TR-59-88.
Order from LC mi$2.70, ph$4.80 PB 143 622

The design details, optical calibration, and operating conditions of the high temperature research facility known as the Arc Image Furnace are discussed. Initial operating conditions are given and some observed data are explained.

Naval Ordnance Test Station, China Lake, Calif.
TENSORS AND THERMODYNAMICS, by A. S. Filler. 12 Sep 56, 134p. 6 refs. NOTS-1581; NAVORD rept. 5331; AD-157 058.
Order from LC mi$6.90, ph$21.30 PB 138 561

The basic principles of thermodynamics and their expression as the first and second laws are examined using tensor analysis. The required tensor methods are those of pure vector geometry and are developed in the report. Several aspects of tensor analysis which are particularly important for physical applications are emphasized. These, in turn, call attention to certain conceptual difficulties in thermodynamics, which are discussed in some detail.

Naval Research Lab., Washington, D. C.
INTERACTION BETWEEN ELECTROMAGNETIC WAVES AND FLAMES. PART 6. THEORETICAL PLOTS OF ABSORPTION, PHASE SHIFT, AND REFLECTION, by W. W. Balwanz. Interim rept. 23 Sep 59, 31p. 7 refs. Rept. 5388.
Order from LC mi$3.00, ph$6.30 PB 142 454

Theoretical studies which attempt to follow the motion of an average particle under a Lorentz force provide expressions for the attenuation of electromagnetic waves in ionized media. The resulting equations are fairly complicated, particularly near the critical (plasma-resonance) frequency of interest in flame studies. As a consequence, graphical presentations are utilized to provide for the interpretation of experimental results. The curves are plotted as a single family in a three-dimensional space, thus simplifying the graphical presentation over the usually presented. This single family may be expanded into the usual series of families by relabeling coordinates. The influence of the magnetic field is ignored, since it is normally a negligible factor in flame studies.

Naval Research Lab., Washington, D. C.
RADIANT HEATING FROM ROCKET EXHAUSTS, by D. C. Rohlfs and W. W. Balwanz. Interim rept. 20 Aug 58, 24p. 4 refs. Rept. 5174.
Order from LC mi$2.70, ph$4.80 PB 133 234

Radiant energy from the exhaust of a static-fired 11-pound-thrust rocket motor has been measured as a function of simulated altitude. Liquid oxygen and RP-1 were used as propellants. The radiant energy was measured with aneroid calorimeters. The exhaust is assumed to have constant total radiated energy, to be non-self-absorbing, and to be homogeneous with cylindrical symmetry. Experimental and theoretical results are in rough qualitative agreement. The effect of conduction currents in the closed chamber was minimized by proper placement of the calorimeters, but the accuracy in evaulating the effect of these currents limits the comparison between theory and experiment. Impingement temperature of the exhaust on a steel plate was also measured as a function of altitude. Experiment shows that the impingement heating becomes more concentrated toward the center of the exhaust with increasing altitude.

Padova U. (Italy).
NUCLEAR RESONANCE IN CONDENSED SYSTEM AT LOW TEMPERATURES. Final technical rept. for 15 May 57-15 May 59 on Contract DA 91-508-EUC-187. 15 June 59, 13p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 143 109

A program on experimental study of nuclear resonance in condensed systems was initiated to understand some microscopic features of the atomic movements. The apparatus needed to accomplish this investigation consists essentially of the following components. (1) The electromagnet, (2) The electronics, (3) The gas manifold system, (4) The cryostat.

Plasmadyne Corp., Santa Ana, Calif.
A CONTINUOUS HIGH TEMPERATURE GAS FLOW FACILITY FOR MAGNETOHYDRODYNAMIC STUDIES, by Vernon H. Blackman. Rept. on Contract AF 49(638)334. 26 June 59, 37p. 7 refs. T-1TN069-334; AFOSR-TN-59-681; AD-225 412.
Order from LC mi$3.00, ph$6.30 PB 143 163

In order to study phenomena which require both a long testing time and high temperature it would be most desirable to combine the steady state flow characteristics of a wind tunnel with the high gas temperature capabilities of a shock tube. This report will describe an attempt to accomplish such a union. The facility to be described was set up in order to study the steady state Hall effect in an ionized gas flow and as a convenient arrangement to look at fluctuations introduced into a flow by means of an electric arc heater. It has also proven to be useful for preliminary experimental studies of the steady acceleration of an ionized gas flow by means of crossed electric and magnetic fields.

Vitro Labs., West Orange, N. J.
ROTATIONAL "TEMPERATURE" MEASUREMENTS OF THE HIGH INTENSITY ARC TAIL FLAME, by A. W. Diniak, C. Roth and others. Technical note no. 4 on Contract AF 18(603)3. 7 Aug 58, 16p. 11 refs. KLX-10113; AFOSR-TN-58-735; AD-201 351.
Order from LC mi$2.40, ph$3.30 PB 143 936

Rotational temperatures in the tail flame of the high intensity arc at atmospheric and at reduced pressures are determined by measuring the radiation

intensity distribution of the rotational fine structure of the C_2 (0, 0) Swan band at λ5165, and of the OH (0, 0) ultraviolet band at λ 3064. A comparison is made between temperatures obtained from the C_2 species, and those obtained from the OH species by both the fundamental and the iso-intensity methods. A discussion of the rotational temperature results obtained is included.

Wave Propagation

Air Force Cambridge Research Center, Bedford, Mass.
TROPOSPHERIC AND IONOSPHERIC SCATTER PROPAGATION IN THE TRANSITION ZONE, by Frank A. Pivarunas. Apr 59, 37p. 15 refs. AFCRC-TR-59-136; AD-214 498.
Order from LC mi$3.00, ph$6.30 PB 143 721

There is a zone of receiver distances in which a transition from tropospheric to ionospheric scatter propagation for the received signals can and does take place for frequencies generally used for ionospheric scatter propagation (between about 35 and 60 Mcps). The diurnal and seasonal variations of the median signal levels in each mode determine when and where the signal levels of both modes are within a few db of each other so that the transition region can occur. Since the fading rates peculiar to the ionospheric scatter mode are different from those of the tropospheric scatter, the transition region is readily recognized by the superimposed fading rates on signal level recordings. The scatter volumes for the transition zone are in the stratosphere for the "tropospheric" scatter mode. This may account for some of the changes in tropospheric scatter signal characteristics as distance increases to reach the transition zone. A mode diversity system to improve reception of signals in this zone by using optimum beamwidths and orientations of the antennas used in transmitting and receiving has been proposed.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
EQUIPMENT FOR CONTINUOUS ECHO AMPLITUDE RECORDING, by Murray E. Sherry. Technical rept. no. 24 on Contract DA 36-039-sc-56748. 1 July 55, 19p. 1 ref. Research rept. EE 251; AD-70 609.
Order from LC mi$2.40, ph$3.30 PB 138 547

A logarithmic amplifier and a pulse shaper were added to the sounder at the Cornell Ionosphere Laboratory in order to take measurements of the amplitude of reflected pulses from the ionosphere as a continuous function of frequency. Details of the construction and diagram are presented here.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
INVESTIGATION OF SUPERSONIC PHENOMENA UNDER EXPLOSIVE CONDITIONS, by W. Philippoff. Final rept. for 28 Feb 58-27 Feb 59 on Contract DA 36-034-ORD-2627. [1959] 38p. 1 ref. F-A2142.
Order from LC mi$3.00, ph$6.30 PB 143 456

We were concerned with the measurement of the propagation of shock waves in transparent materials. Instantaneous photography of the stress pattern in polarized light was used. A number of cases were found that suggested supersonic propagation of stress waves in glass. As the verification of such propagation could be of interest, it was decided to sponsor research to ascertain the existence, nature and behavior of this new kind of wave.

Institute of Aerophysics, U. of Toronto (Canada).
BLAST FROM A PRESSURIZED SPHERE, by D. W. Boyer, H. L. Brode and others. Rept. on Contract Nonr-2335(00). Jan 58, 100p. 20 refs. Rept. no. 48; AD-162 002.
Order from LC mi$5.40, ph$15.30 PB 142 915

Numerical solutions are given for the variation of all flow quantities, as functions of time and space, for the 2-inch diameter air and helium sphere cases. Schlieren photographs of the corresponding experimental blasts are in good qualitative agreement with the theoretical wave diagrams and a quantitative comparison of the 2-inch diameter air sphere blast with theory shows fair agreement. The schlieren and shadowgraph flow records show that the main spherical shock wave is formed by a process of overtaking and coalescing compression waves in a manner somewhat similar to the development of a plane shock wave in a conventional shock tube. Differences between the theoretical and experimental flows are principally due to the finite bursting time of the glass spheres in practice.

Institute of Mathematical Sciences, New York U., N. Y.
BOUNDS ON THE ELEMENTS OF THE EQUIVALENT NETWORK FOR SCATTERING IN WAVEGUIDES. I. THEORY, by Larry Spruch and Ralph Bartram. Rept. on Contract AF 19(604)5238. Apr 59, 33p. 14 refs. Research rept. no. EM-132; AFCRC-TN-59-187; AD-215 064.
Order from LC mi$3.00, ph$6.30 PB 142 811

For a few particular waveguide problems, standard variational expressions have previously been shown to be upper or lower bounds on the quantities of interest. However, bounds have not previously been obtained for any truly three dimensional problem, that is, where the fields cannot be derived from a single scalar potential. An example is a three dimensional obstacle which contacts only one waveguide surface. As one consequence, no straightforward procedure exists for improving the approximations. Recently, Kato devised a rather general method for bounding the cotangent of the phase shift for a given angular momentum in a quantum mechanical central potential scattering problem. This method should be applicable whenever a system can be analyzed in terms of uncoupled standing waves each characterizable by one real phase shift. The method is here adapted to waveguides, including truly three dimensional problems. The obstacle must be symmetric about a plane perpendicular to the waveguide axis, with certain exceptions only one mode should propagate, and the system should be lossless. Analysis is then possible in terms of η_e and η_o, the real uncoupled phase shifts associated with the even and odd

standing waves, respectively. The bounds obtained on $\cot\theta_e$ and $\cot\eta_o$ determine bounds on the equivalent network elements.

Michigan U. Coll. of Engineering, Ann Arbor.
TRANSVERSE WHISTLER PROPAGATION, by C. O. Hines, W. C. Hoffman, and H. Weil. Final rept. on Contract AF 19(604)5553. June 59, 38p. 21 refs. 2894-1-F; AFCRC TR-59-180., AD-226 123.
Order from LC mi$3.00, ph$6.30 PB 143 019

Transpolar propagation of ion-electron whistler modes is investigated and shown, with the help of numerically computed rays, not to be useful for transmitting information. The first two sections of the report comprise a summary of whistler phenomena and theory to provide a background for the present investigation. In Section III a specific ion-electron density distribution is introduced and applied to the appropriate Haselgrove ray tracing equations. In Section IV the numerical results for transpolar propagation are presented.

Naval Research Lab., Washington, D. C.
EFFECT OF DIELECTRIC CONSTANT ON CERTAIN CHARACTERISTICS OF PLANE ELECTROMAGNETIC WAVES IN NONMAGNETIC CONDUCTIVE MEDIA, by L. S. Bearce and R. W. Zeek. Final rept. 19 Oct 59, 10p. Rept. 5381.
Order from LC mi$1.80, ph$1.80 PB 142 452

The error resulting from omission of the dielectric constant as a factor in expressions for the rate of attenuation, the phase velocity, and the wavelength of plane electromagnetic waves in nonmagnetic media has been considered. The variation of these quantities as a function of frequency for water of various conductivities has been calculated, with special attention given to the case of sea water. Universal curves applicable to any nonmagnetic media are presented for use in propagation studies.

Naval Research Lab., Washington, D. C.
PROPAGATION MEASUREMENTS IN THE 5-MILLIMETER REGION, by K. M. Decker and R. C. Dodson. Final rept. 19 Oct 59, 15p. 7 refs. Rept. 5385.
Order from LC mi$2.40, ph$3.30 PB 142 453

The atmospheric absorption of electromagnetic radiation in the region of 5 to 6 mm has been measured and has been found to vary from 14.1 db/km at 5.08 mm to 1.02 db/km at 5.66 mm for dry air at a temperature of 68°F and a pressure of 29.92 in. Hg. Corrections for temperature and pressure, as determined theoretically by previous investigators, have been assumed correct, whereas the corrections due to uncondensed water vapor were determined experimentally and were found to vary from 0.05 db/km at 5.6 mm to 0.09 db/km at 5.08 mm for each gram of uncondensed water vapor per cubic meter.

Radiation Lab., Johns Hopkins U., Baltimore, Md.
BACK-SCATTERING CHARACTERISTICS OF THE SEA IN THE REGION FROM 10 TO 50 KMC, by J. C. Wiltse, S. P. Schlesinger, and C. M. Johnson. Rept. on Contract Nord--11299. May 56, 70p. 5 refs. RL/JHU/TR-35; AD-156 438.
Order from LC mi$3.90, ph$10.80 PB 138 595

Measurements of back scattering from the ocean have been made over the frequency range from 10 to 50 kMc by means of several CW doppler microwave systems operating simultaneously. The systems were mounted on the bow of a ship and various antenna depression angles from 0° (horizontal) to 90° were used. Data were obtained for vertical, horizontal, and circular polarization, and for the cross-polarized component of vertically polarized radiation. Horn antennas of 20 db gain were used at each frequency of operation, and, in addition, higher and lower gain antennas were used at certain selected frequencies. Signals recorded from a variety of sea conditions have been used to calculate the back-scattering cross section per unit area, σ^o. These calculations indicate that σ^o is nearly constant with microwave frequency and increases as the antenna depression angle is increased. The doppler frequency characteristics of the returned signals have also been obtained from the measurements. A comparison is made between the results obtained and those predicted theoretically from simple scattering mechanisms.

Stanford Electronics Labs., Stanford U., Calif.
AIR MOTIONS AND THE FADING DIVERSITY AND ASPECT SENSITIVITY OF METEORIC ECHOES, by L. A. Manning. Technical rept. no. 50 on Contract Nonr-225(24). 10 Dec 58, 33p. 14 refs.
Order from LC mi$3.00, ph$6.30 PB 143 844

A theory is presented that relates those properties of meteoric echoes that depend on distortion of the trail by winds. It is shown that existing results concerning the delay in the start of echo fading (Greenhow), the delay in echo appearance with aspect (McKinley and Millman), the spectral composition of the received signal (Manning, Villard, and Peterson), and the regularity of the fading pattern, are quantitatively explicable. In addition, the theory predicts that the ensemble average rate of echo fading should rise characteristically with time, and should then drop precipitously at the end of the ensemble echo; moreover, it predicts that the correlation of fading patterns at two ground receivers should be a Gaussian function of the product of receiver spacing and echo fading cycle-number. Experimental results are given confirming these predictions, and making possible the determination of the principal properties of the wind profile.

Stanford Electronics Labs., Stanford U., Calif.
THEORY OF RADAR STUDIES OF THE CISLUNAR MEDIUM, by V. R. Eshleman, R. C. Barthle, and P. B. Gallagher. Scientific rept. no. 5 on Contract AF 19(604)2193. 8 July 59, 25p. 13 refs. AFCRC-TN-59-381.
Order from LC mi$2.70, ph$4.80 PB 143 199

In two of the methods described here, the full average-power capability of an h-f transmitter can be used without regard to high stability or precise lunar range. In one method, three equally-spaced

frequencies are sent in the form of an amplitude-modulated wave. Thus a reference quantity is, in effect, sent with the measuring quantities. The relative phases, and hence the character of the modulation, are changed due to dispersion in the cislunar medium. For example, a direct measure of the integrated ion density would be the value of the modulating frequency at which an amplitude-modulated signal is changed to a frequency-modulated echo. In another method an h-f and a vhf transmitter are modulated by the same audio signal. The difference of the audio phase in the simultaneously-recorded echoes should be a measure of the integrated ion density.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
PROCEEDINGS OF CONFERENCE OF LABORATORY CHIEFS NO. 1, 24-27 OCTOBER 1955. 223p.
Order from LC mi$9.90, ph$34.80 PB 143 438

Improving Relationships and Personnel Management in Research and Development Laboratories.

Communication Theory

Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.
RESEARCH INVOLVING COMMUNICATION PROCESSES IN TASK ORIENTED GROUPS, by Thornton B. Roby, Bernard W. Harleston and Lorraine D. Eyde. Technical rept. no. 1 on Contract Nonr-494(15). 15 Nov 58, 5p.
Order from LC mi$1.80, ph$1.80 PB 143 465

Willow Run Labs., U. of Michigan, Ann Arbor.
RESEARCH IN MACHINE TRANSLATION, II. RUSSIAN PHYSICS VOCABULARY WITH FREQUENCY COUNT: RIGHT-TO-LEFT ALPHABETIZATION, by A. Koutsoudas and A. Halpin. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Sep 58, 81p. Rept. no. 2144-312-T.
Order from LC mi$4.80, ph$13.80 PB 143 545

A list of words, with frequencies, occurring in a Russian physics text of 73,364 running words, was taken from the Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki (Journal of Experimental and Theoretical Physics), and alphabetized from right to left. The list provides raw data for a morphological analysis of compound words and derivational and inflectional suffixes.

Zator Co., Cambridge, Mass.
A PROGRESS REPORT ON MACHINES TO LEARN TO TRANSLATE LANGUAGES AND RETRIEVE INFORMATION, by R. J. Solomonoff. Rept. on Contract AF 49(638)376. Oct 59, 21p. 4 refs. ZTB-134; AFOSR-TN-59-646.
Order from OTS $0.75 PB 161 263

This paper discusses theoretical work which makes it possible for a machine to be programmed to learn to translate between two simple, synthetic languages, after it has been given a large set of correct examples in a suitable training situation. The limitations of the methods are discussed. A system is described in which a machine would learn to assign descriptors or other search indices to documents, after having been given a large set of documents and the search indices that have been assigned to them by humans. Some of the problems that must be solved before such a system can be realized are discussed. A unified method is proposed for resolving the difficulties of both the information retrieval and the mechanical translation routines.

Photographic Equipment

Georgetown Coll. Observatory, Washington, D. C.
A FAST-ACTION MULTIPLATE CAMERA, by F. J. Heyden and Mark W. Rudy. Technical rept. no. 10 on Contract AF 19(604)2229. Aug 58, 5p. Monograph no. 11; AFCRC-TN-58-612; AD-207 640.
Order from LC mi$1.80, ph$1.80 PB 138 413

The following is a description of a mechanically operated camera in which glass photographic plates may be rapidly exposed and shifted to a light-tight storage chamber. The camera will hold fifty 2-1/4 by 3-1/4 plates and the entire load may be run through the camera in approximately one minute.

International Telemeter Corp., Los Angeles, Calif.
DISC PROCESSING. Technical rept. no. 19 on [Contract AF 30(602)1566] 12 Nov 57, 12p. RADC-TN-58-9; AD-148 542.
Order from LC mi$2.40, ph$3.30 PB 144 031

The disk, after exposure to the various films, will be located emulsion side down on the platen in the top of the film-to-disk camera. In the center hole of the disk is a plastic bushing, and the disk holder rests on the disk. A disk processing procedure is outlined which includes unloading of the camera, chemical processing, and washing. In this connection, it appeared most practical to keep the developer always at 70°F. A survey of imperfections in the films and disks indicated 2 types of imperfections with regard to nature and origin: dirt and electromechanical difficulties.

SOCIAL SCIENCES

Columbia U., New York.
LIST OF SAMPLE PARAMETERS OF QUANTITATIVE PROPERTIES OF LANDFORMS: THEIR USE IN DETERMINING THE SIZE OF GEOMORPHIC EXPERIMENTS, by Mark A. Melton. Technical rept. no. 16 on Contract N6onr-271, T. O. 30. 1958, 20p. 19 refs. AD-206 831.
Order from LC mi$2.40, ph$3.30 PB 144 147

Considerable time, money, and effort in conducting experiments of a statistical nature can be saved by planning the size of an experiment in accordance with chosen values for (1) the probability of incorrectly accepting or rejecting the null hypothesis, and (2) the minimum difference in population parameters to be detected. For student's tests and analyses of variance, estimates of population variances are necessary. Investigations into quantitative properties of landforms are made difficult by scarcity of such estimates. The list of sample parameters presented provides estimates of variance, means, and coefficients of variation for populations that were studied. Brief descriptions of the geologic and climatic environments from which each sample was drawn allow selection of the sample most nearly like the experimental material.

National Bureau of Standards, Washington, D. C.
DISTRIBUTION OF MAIL BY DESTINATION AT THE SAN FRANCISCO, LOS ANGELES AND BALTIMORE POST OFFICES, by Norman C. Severo and Arthur E. Newman. Dec 59, 55p. Technical note 27.
Order from OTS $1.50 PB 151 386

This report presents the results of the application of the sampling method presented in a paper by Norman C. Severo and Arthur E. Newman entitled "A statistical chain-ratio method for estimating relative volumes of mail to given destinations", to appear in NBS Journal of Research 64C, No. 1 (Jan.-Mar. 1960) These studies were made at the San Francisco, Los Angeles, and Baltimore Post Offices.

Princeton U., N. J.
ON THE MAGNIFICATION OF DERIVED DEMAND, by R. G. Davis and W. G. Mellon. Research memo. no. 4 on Econometric Research Program, Contract Nonr-1858(16). 12 Nov 58, 24p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 143 570

Stanford U., Calif.
WELFARE ECONOMICS AND EXISTENCE OF AN EQUILIBRIUM FOR A COMPETITIVE ECONOMY, by Takashi Negishi. Technical rept. no. 62 on Contract N6onr-25133. 9 Dec 58, 10p. 9 refs.
Order from LC mi$1.80, ph$1.80 PB 143 843

It is proven that a competitive equilibrium is the maximum of a social welfare function which is a linear combination of utility functions of consumers, with the weight in the combination being in inverse proportion to the marginal utility of income.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Jan 60.
Order from OTS $1.25, $10.00/year PB 161 277

Contents:
Articles:
A Co^{60} source for radiation chemistry research, by V. J. Linnenbom, C. H. Cheek, and J. M. Frame
Electron spin resonance line shape of diphenyl-picryl-hydrazyl dissolved in benzene, by J. I. Kaplan
Scientific Program:
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Metallurgy and Ceramics: Effects of environment on the high-temperature properties of metals. The structure of $CbZn_3$. Determination of zirconium in columbium. Explosion test performance of small-scale submarine hull weldments. Notch toughness evaluations of modified HY-80 steel in heavy-gage plates. Effect of some composition variables on the performance of zinc anodes for cathodic protection in sea water
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Biology and Medicine

Radium and mesothorium poisoning and dosimetry and instrumentation techniques in applied radioactivity. Annual progress report, by Robley D. Evans. U. S. Atomic Energy Commission, Division of Biology and Medicine, Oak Ridge, Tenn. May 59. Contract AT(30-1)-952. 164p. Order from OTS. $3.00. AECU-4285

The development of chelating agents for enhancing the urinary excretion of strontium. Period covered: September 1, 1958 to September 1, 1959, by Harry Kroll and others. Montefiero Hospital, New York. Sep 59. Contract AT(30-1) 2094. 44p. Order from LC. Mi $3.30, ph $7.80. AECU-4322

The metabolism and toxicology of strontium-90 in the rat. Rationale, experimental procedures, pilot experiments, by L. W. Tuttle, R. C. Baxter, M. Goldman, and W. F. Bale. University of Rochester. Atomic Energy Project, Rochester, N. Y. Sep 59. Contract W-7401-eng-49. 28p. Order from OTS. $1.00. UR-424

Field studies of fission product inhalation. Part III: Fission product field release test series one (EPERT-I), by Robert G. Thomas and Robert H. Wilson. University of Rochester. Atomic Energy Project, Rochester, N. Y. Oct 59. Contract W-7401-eng-49. 145p. Order from OTS. $2.75. UR-555

Metabolism in the rat studied by isotope techniques. II. The body burden of mercury after single and multiple injections, by A. Rothstein and A. Hayes. University of Rochester. Atomic Energy Project, Rochester, N. Y. Oct 59. Contract W-7401-eng-49. 17p. Order from OTS. 50 cents. UR-556

Deposition of a radioactive aerosol in excised guinea pig lungs, by F. R. Gibb, Paul E. Morrow, and Lucien Dautrebande. University of Rochester. Atomic Energy Project, Rochester, N. Y.. Nov 59. Contract W-7401-eng-49. 18p. Order from OTS. 75 cents. UR-560

Proceedings of the second annual meeting on bioassay and analytical chemistry, November 3 and 4, 1958, by T. Kwasnoski and others. University of Rochester. Atomic Energy Project, Rochester, N. Y. Sep 59. 153p. Order from OTS. $3.00. WASH-1023

A review of potential radionuclides produced in weapons detonations, by Alfred W. Klement, Jr. U. S. Atomic Energy Commission, Division of Biology and Medicine, Washington, D. C. July 59. 111p. Order from OTS. $1.00. WASH-1024

Chemistry—General

Nuclear magnetic resonance spectra of nitrogen-1 in ruthenium nitrosyl complexes, by B. B. Murray. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Analytical Chemistry Division, Aiken, S. Car. June 59. Contract AT(07-2)-1. 8p. Order from OTS. 50 cents. DP-391

Determination of deuterium, oxygen, and nitrogen in helium by gas chromatography, by D. L. West. E. I. du Pont de Nemours & Co. Savannah River Laboratory, Analytical Chemistry Division, Aiken, S. Car. Sep 59. Contract AT(07-2)-1. 8p. Order from OTS. 50 cents. DP-392

Power reactor fuels reprocessing progress report on corrosion studies, by R. F. Maness. Hanford Atomic Products Operation, Chemical Research and Development Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 61p. Order from OTS. $1.50. HW-61662

Analytical program for processing stainless steel uranium dioxide reactor fuel elements, by G. A. Huff. Phillips Petroleum Co. Atomic Energy Division, Idaho Falls, Idaho. Sep 59. Contract AT(10-1)-205. 20p. Order from OTS. 75 cents. IDO-14493

Quantitative gamma-ray spectrometric analysis of nuclide mixtures consecutive standard sources nullification, by D. G. Olson. Chemical Processing Plant. Operated by Phillips Petroleum Co. Atomic Energy Division, Idaho Falls, Idaho. Oct 59. Contract AT(10-1)-205. 23p. Order from OTS. 75 cents. IDO-14495

Observations on creep of tantalum, by G. Murphy and R. E. Uhrig. Iowa State University of Science and Technology. Ames, Laboratory, Ames, Iowa. Aug 59. Contract W-7405-eng-82. 29p. Order from OTS. $1.00. IS-26

A method of specimen corrosion protection for high temperature creep testing, by J. R. Bohn, R. E. Uhrig and G. Murphy. Iowa State University of Science and Technology. Ames Laboratory, Ames, Iowa. Oct 59. Contract W-7405-eng-82. 16p. Order from OTS. 50 cents. IS-48

Phase diagrams of nuclear reactor materials, by R. E. Thoma. Oak Ridge National Laboratory, Reactor Chemistry Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 206p. Order from OTS. $3.50. ORNL-2548

Thermodynamic estimate of the reaction of hydrogen with oxygen-bearing impurities in Salado salt at elevated temperatures, by W. D. Bond and W. E. Clark. Oak Ridge National Laboratory. Chemical Technology Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 24p. Order from OTS. 75 cents. ORNL-2600(Deleted)

The configurational relationship of 1, 2, 2-triphenylethylamine and 1, 2, 2-triphenylethanol, J. B. Christie. Oak Ridge National Laboratory. Chemistry Division, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 79p. Order from OTS. $2.25. ORNL-2786

Electrolytic disintegration of Zircaloy-2 in nitric acid solutions, by W. E. Clark and S. Peterson. Oak Ridge National Laboratory. Chemical Technology Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 18p. Order from OTS. 75 cents. ORNL-2824

Micro-electrophoretic determination of the zeta potential of thorium oxide, by C. M. Boyd, H. P. House and O. Menis. Oak Ridge National Laboratory. Analytical Chemistry Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 24p. Order from OTS. 75 cents. ORNL-2836

Hydroclimatology and surface hydrology of San Clemente Island, by J. B. Knox and H. Zodtner. University of California. Lawrence Radiation Laboratory, Livermore, Calif. Oct 59. Contract W-7405-eng-48. 22p. Order from OTS. 75 cents. UCRL-5709

Bio-organic chemistry quarterly report, March, April, May 1959, by G. Tollin, D. R. Kearns and others. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 59. Contract W-7405-eng-48. 80p. Order from OTS. $2.25. UCRL-8848

The crystal structures of several organic compounds, by F. J. Strieter. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 41p. Order from OTS. $1.50. UCRL-8906

The recovery of uranium from reduction residues by semicontinuous ion exchange, by N. J. Setter, J. M. Googin, and G. B. Marrow. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 21p. Order from OTS. 75 cents. Y-1257

Chemistry—Separation Processes for Plutonium and Uranium

Characterization of surfactants in aluminum-uranium fuel reprocessing solutions, by R. D. Cannon. Phillips Petroleum Co. Atomic Energy Division, Idaho Falls, Idaho. Oct 59. Contract AT(10-1)-205. 17p. Order from OTS. 75 cents. IDO-14489

Recovery of uranium and plutonium from sulfuric acid decladding solutions, by D. E. Horner and C. F. Coleman. Oak Ridge National Laboratory. Chemical Technology Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 46p. Order from OTS. $1.50. ORNL-2830

Controlled Thermonuclear Processes

Proceedings of symposium on magnetic field design in thermonuclear research held at Gatlinburg, Tennessee, December 11 and 12, 1958. Oak Ridge National Laboratory, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 90p. Order from OTS. $2.25. ORNL-2745

Cross sections for the dissociation of H_2^+ and D_2^+ by a vacuum carbon arc, by R. G. Alsmiller, Jr. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 19p. Order from OTS. 75 cents. ORNL-2766

Coherent radiation from a plasma, by E. G. Harris and A. Simon. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 11p. Order from OTS. 50 cents. ORNL-2803

Diffusion of plasma particles across a magnetic field, by A. Isihara and A. Simon. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 10p. Order from OTS 50 cents. ORNL-2826

Critical current for burnout in an OGRA-type device, by A. Simon. Oak Ridge National Laboratory. Neutron Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 50p. Order from OTS. $1.50. ORNL-2831

Proceedings of a conference on the theoretical aspects of controlled fusion research held at Gatlinburg, Tennessee, April 27-28, 1959. Oak Ridge National Laboratory, Oak Ridge, Tenn. Nov 59. 22p. Order from OTS. $3.00 TID-7582

A theory on a homopolar device, by C. C. Chang and T. S. Lundgren. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 23p. Order from OTS. 75 cents. UCRL-8877

Criticality Studies

An empirical interpretation of annuli critical mass data, by C. L. Schuske and G. H. Bidinger. The Dow Chemical Co. Rocky Flats Plant, Technical Section, Denver, Colo. Oct 59. Contract AT (29-1)-1106. 25p. Order from OTS. 75 cents. RFP-149

Critical measurements on near-homogeneous BeO-moderated, oralloy-fueled systems, by F. A. Kloverstrom, R. M. R. Deck, and A. J. Reyenga. University of California. Lawrence Radiation Laboratory, Livermore, Calif. July 59. Contract W-7405-eng-48. 14p. Order from OTS. 50 cents. UCRL-5369 Pt. 1

Geology and Mineralogy

Induced polarization. A study of its causes and magnitudes in geologic materials, by T. R. Madden and D. J. Marshall. Massachusetts Institute of Technology, Cambridge, Mass. June 59. Contract AT(05-1)-718. 71p. Order from OTS. Order from OTS. $2.25. RME-3160

Health and Safety

Fisson product release from uranium heated in air, by R. K. Hilliard. Hanford Atomic Products Operation, Chemical Effluents Technology, Chemical Research and Development Operation, Richland, Wash. Aug 59. Contract AT(45-1)-1350. 36p. Order from OTS. $1.25. HW-60689

Evaluation of fallout data, by A. A. Jarrett. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Dec 59. Contract AT(11-1)-GEN-8. 16p. Order from OTS. 50 cents. NAA-SR-3972

Radiation accidents: Dosimetric aspects of neutron and gamma-ray exposures, by G. S. Hurst and R. H. Ritchie. Oak Ridge National Laboratory, Health Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 120p. Order from OTS. $2.75. ORNL-2748

Health Physics Division annual progress report for period enging July 31, 1959, by K. Z. Morgan. Oak Ridge National Laboratory, Oak Ridge Tenn. (nd). Contract W-7405-eng-26. 221p. Order from OTS. $3.50. ORNL-2806

Instruments

Development of remote metallographic equipment for the ANL Metallurgy Division, by S. H. Paine and F. L. Brown. Argonne National Laboratory, Metallurgy Division, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 29p. Order from OTS. $1.00. ANL-5364

A cladding thickness tester for zirconium over uranium, by A. P. Holt. E. I. du Pont de Nemours & Co. Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. Car. Sep 59. Contract AT(07-2)-1. 12p. Order from OTS. 50 cents. DP-408

An aural alpha-beta-gamma monitor, by W. G. Spear and G. D. Crouch. Hanford Atomic Products Operation. Instrument Research and Development, Physics and Instrument Research and Development Operation, Richland, Wash. May 59. Contract W-31-109-Eng-52. 22p. Order from OTS. 75 cents. HW-56128 REV

A stack effluent radioisotope monitor, by R. A. Harvey. Hanford Atomic Products Operation. Instrument Research and Development, Physics and Instruments Research and Development Operation, Richland, Wash. Oct 58. Contract W-31-109-Eng-52. 36p. Order from OTS. $1.25. HW-56151 REV

A null balance x-ray absorption instrument for chemical process monitoring, by B. E. Dozer. Hanford Atomic Products Operation. Chemical Research and Development Operation, Richland, Wash. June 59. Contract W-31-109-Eng-52. 62p. Order from OTS. $1.75. HW-60898

Dose and flux measurements on Godiva radiation effects experiments, by P. S. Harris, E. F. Montoya, and W. H. Schweitzer. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Nov 59. Contract W-7405-ENG-26. 16p. Order from OTS. 75 cents. LA-2355

Instrumentation and controls division annual progress report for the period ending July 1, 1959, by C. J. Borkowski and C. S. Harrill. Oak Ridge National Laboratory, Oak Ridge, Tenn. 1959. Contract W-7405-eng-26. 160p. Order from OTS. $3.00. ORNL-2787

A magnetic core circuit for the reliable production of single pulses from contacts, by R. J. Klein. Oak Ridge National Laboratory. Instrumentation and Controls Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 47p. Order from OTS. $1.50. ORNL-2794

A versatile instrument camera with a microsecond electronic shutter, by C. H. Schalbe. Oak Ridge National Laboratory. Instrumentation and Controls Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 52p. Order from OTS. $1.50. ORNL-2804

Single-channel gamma ray spectrometer, model G-1, by J. R. Mann. The Dow Chemical Co. Rocky Flats Plant, Health Physics Department, Denver, Colo. Nov 59. Contract AT(29-1)-1106. 32p. Order from OTS. $1.00. RFP-162

Inflatable gasket for the 72-inch bubble chamber, by L. R. Lucas and H. P. Hernandez. University of California. Laboratory, Berkeley, Calif. July 59. Contract W-7405-eng-48. 50p. Order from OTS. $1.50. UCRL-8526Rev

Production leak rate detection systems, by H. S. Corey, III. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Nov 59. Contract W-7405-eng-26. 26p. Order from OTS. $1.00. Y-1275

Determination of metallic impurities in uranyl nitrate solutions by X-ray fluorescence, by R. E. Sladky. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Dec 59. Contract W-7405-eng-26. 25p. Order from OTS. 75 cents. Y-1276

Optimizing the ratio of time constant to radiation level for precision count-rate meters, by A. H. Fowler and R. A. McLean. Union Carbide Nuclear Co. Division of Union Carbide Corp., Y-12 Plant, Oak Ridge, Tenn. Dec 59. Contract W-7405-eng-26. 18p. Order from OTS. 75 cents. Y-1278

Metallurgy and Ceramics

Hanford experience in the nondestructive testing of nuclear process vessels and process piping, by R. B. Socky. Hanford Atomic Products Operation, General Electric Co., Richland, Wash. Oct 58. 68p. Order from OTS. $2.00. AECU-4274

Some aspects of the beta to alpha transformation in uranium: Metallographic structure and orientation relationships, by H. H. Chiswick and L. T. Lloyd. Argonne National Laboratory, Metallurgy Division, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 22p. Order from OTS. 75 cents. ANL-5777

Corrosion of aluminum-uranium alloys in high-temperature water, by W. E. Ruther and J. E. Draley. Argonne National Laboratory, Metallurgy Division, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 8p. Order from OTS. 50 cents. ANL-6053

Solubility limits of yttrium and the lanthanide rare-earth elements in chromium and chromium-iron alloys, by S. G. Epstein, A. A. Bauer, and R. F. Dickerson. Battelle Memorial Institute, Columbus, Ohio. Sep 59. Contract W-7405-eng-92. 16p. Order from OTS. 75 cents. BMI-1376

Progress relating to civilian application during August, 1959, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Sep 59. Contract W-7405-eng-92. 99p. Order from OTS. $2.50. BMI-1377

Progress relating to civilian application during September, 1959, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 95p. Order from OTS. $2.50. BMI-1381

A study of the effects of fabricating conditions on some properties of sintered uranium monocarbide, by A. B. Tripler, Jr., M. J. Snyder, and W. H. Duckworth. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 15p. Order from OTS. 75 cents. BMI-1383

The solid solubility and constitution of yttrium in iron-20 to 40 w/o chromium alloys, by M. S. Farkas and A. A. Bauer. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405-eng-92. 22p. Order from OTS. 75 cents. BMI-1386

A visual study of the corrosion of defected Zircaloy-2-clad fuel specimens by hot water, by E. F. Stephan, P. D. Miller, and F. W. Fink. Battelle Memorial Institute, Columbus, Ohio. Oct 59. Contract W-7405- eng-92. 31p. Order from OTS. $1.00. BMI-1387

Mechanical properties of uranium plate, by G. R. Caskey, Jr. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Lab., Aiken, S. Car. June 59. Contract AT(07-2)-1. 22p. Order from OTS. 75 cents. DP-376

Interim report on the hydrostatic destructive testing of Zircaloy-2 pressure tubing, by V. E. Kahle. Hanford Atomic Products Operation. Richland, Wash. Oct 59. Contract AT(45-1)-1350. 51p. Order from OTS. $1.50. HW-61272 REV

Corrosion of Inconel in 600°F static water, by G. E. Galonian and H. L. Tymchyn. General Electric Co. Knolls Atomic Power Lab., Schenectady, N. Y. May 59. Contract W-31-109-Eng-52. 25p. Order from OTS. 75 cents. KAPL-2047

Terminal status report for the processing refabrication experiment, by D. I. Sinizer, K. L. Mattern, E. G. Kendall and others. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 202p. Order from OTS. $3.50. NAA-SR-3269

Hot-pressure bonding of OMR fuel plates, by G. V. Alm, M. H. Binstock, and E. E. Garrett. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 61p. Order from OTS. $1.75. NAA-SR-3583

Casting development for uranium-molybdenum alloy shapes, by M. H. Binstock and J. A. Stanley. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1)-GEN-8. 28p. Order from OTS. 75 cents. NAA-SR-4030

Fused silica for reactor applications. Progress report no. 1, project no. B-153 for November 14, 1958 to August 15, 1959, by J. D. Fleming and J. W. Johnson. Georgia Institute of Technology, Atlanta, Georgia. Nov 59. Contract AT-(40-1)-2483. 65p. Order from OTS. $1.75. ORO-209

Thoria-urania pellet preparation, by H. Shapiro and R. M. Powers. Sylvania-Corning Nuclear Corp., Bayside, Long Island, N. Y. Aug 59. Contract AT-30-GEN-366. 34p. Order from OTS. $1.00. SCNC-290

Recoil range of fission fragments in zirconium, by E. R. Smith and P. W. Frank. Westinghouse Electric Corp. Bettis Atomic Power Laboratory, Pittsburgh, Pa. Nov 59. Contract AT-11-1-GEN-14. 8p. Order from OTS. 50 cents. WAPD-TM-198

Cost of blending uranium of two different U^{235} isotopic enrichments. {Values of uranium from the "USAEC unclassified pricing list"}. Union Carbide Nuclear Company. Division of Union Carbide Corp., Process Analysis Department, Y-12 Plant, Oak Ridge, Tenn. Dec 59. Contract 7405-eng-26. 270p. Order from OTS. $4.00. Y-1258

Physics and Mathematics

Flow through microporous media vapor transfer through barriers, by L. O. Rutz and K. Kammermeyer. State University of Iowa. Department of Chemical Engineering, Iowa City, Iowa. July 59. Contract AT(11-1)-237. 59p. Order from OTS. $1.75. AECU-4328

Variable metric method for minimization, by W. C. Davidon. Argonne National Laboratory, Lemont, Ill. Nov 59. Contract W-31-109-eng-38. 21p. Order from OTS. 75 cents. ANL-5990 Rev.

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High-flux heat transfer studies: An analytical investigation of laminar film boiling, by P. W. McFadden and R. J. Grosh. Argonne National Laboratory, Lemont, Ill. Oct 59. Contract W-31-109-eng-38. Sub-contract 31-109-38-704. 59p. Order from OTS. $1.75. ANL-6060

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Uranium-235 fission product activity and energy as a function of decay time for a specific irradiation time and thermal flux, by C. B. Magee. General Electric. Atomic Products Division, Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Apr 59. Contracts AT(11-1)-171 and AF 33(600)-38062. 20p. Order from OTS. 75 cents. APEX-530

IBM 704 program report, aircraft nuclear propulsion shielding program 09-0, by J. W. Haffner, J. J. Loechler, and J. E. MacDonald. General Electric. Atomic Products Division, Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Dec 58. Contracts AT(11-1)-171 and AF 33(600)-38062. 32p. Order from OTS. $1.00. APEX-533

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Equations of state of liquid and gaseous normal hydrogen and the application of multiple regression techniques to curve fitting, by R. H. Sherman and others. University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Oct 59. Contract W-7405-ENG-36. 32p. Order from OTS. $1.00. LAMS-2357

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Perturbation theory and reactor analysis, by E. Blue and J. W. Zink. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Nov 59. Contract AT(11-1) GEN-8. 15p. Order from OTS. 50 cents. NAA-SR-4351

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Energy and angular distribution of the particles resulting from the collision of a 15 Bev proton with a nucleon at rest, by W. Smith. Midwestern Universities Research Association, Madison, Wis. Sep 59. Contract AT(11-1)-384. 36p. Order from OTS. $1.00. MURA-530

Bevatron operation and Development. XX. November, December 1958, January 1959, by W. D. Hartsough. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 23p. Order from OTS. 75 cents. UCRL-8834

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Radioactive Waste

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Reactors—General

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Reactors—Power

Boiling water reactor with internal superheater; Pathfinder Atomic Power Plant final feasibility report. Allis-Chalmers Manufacturing Co. Atomic Energy Division, Milwaukee, Wis. Aug 59. Contract AT(11-1)-589. 86p. Order from OTS. $2.25. ACNP-5917

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Continuous solvent washing - Hydraulic operating characteristics of a large-scale continuous solvent washer, by A. A. Kishbaugh. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Division, Technical Division, Savannah River Lab., Aiken, S. Car. Apr 59. Contract AT(07-2)-1. 16p. Order from OTS. 50 cents. DP-333

Electrodeposition of plutonium at a mercury cathode, by J. A. Porter and others. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic

The ORNL four-linear-element package analog computer (FLEPAC) instruction manual, by F. P. Green. Oak Ridge National Laboratory, Instrumentation and controls Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 32p. Order from OTS. $1.00. ORNL-2727

Generalized heat conduction code for the IBM-740 computer, by T. B. Fowler and E. R. Volk. Oak Ridge National Laboratory, Reactor Experimental Engineering Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 66p. Order from OTS. $1.75. ORNL-2734

Fission products poisoning data, by N. J. Pattenden. Oak Ridge National Laboratory, Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 28p. Order from OTS. $1.00. ORNL-2778

A study of alpha particle ionization in argon mixtures, by F. W. Sanders, G. S. Hurst, and T. E. Bortner. Oak Ridge National Laboratory. Health Physics Division, Oak Ridge, Tenn. Oct 59. Contract W-7405-eng-26. 58p. Order from OTS. $1.75. ORNL-2807

Scintillation spectroscopy measurements of gamma-ray energies from sources of Y^{88}, Mn^{54}, and Zn^{65}, by R. W. Peelle and T. A. Love. Oak Ridge National Laboratory, Neutron Physics, Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 33p. Order from OTS. $1.00. ORNL-2790

Tables for a semi-infinite circular current sheet, by N. B. Alexander and A. C. Downing. Oak Ridge National Laboratory. Mathematics Panel, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 181p. Order from OTS. $3.00. ORNL-2828

Neutron Physics Division annual progress report for period ending September 1, 1959, by E. P. Blizard and others. Oak Ridge National Laboratory. Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 237p. Order from OTS. $4.00. ORNL-2842

Studies of the spherical harmonics method in neutron transport theory. III. Distribution of the roots of the characteristic equation in the case of anisotropic scattering, by W. Kofink. Oak Ridge National Laboratory, Physics Division, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 32p. Order from OTS. $1.00. ORNL-2850

High-energy particle data. Volume I, by B. H. Willis and C. V. Stableford. University of California. Radiation Laboratory, Berkeley, Calif. Nov 56. Contract W-7405-eng-48. 88p. Order from OTS. $2.25. UCRL-2426(rev.)

Proceedings of the second symposium on advances in fast-pulse techniques for nuclear counting held at the Lawrence Radiation Laboratory, February 12 and 13, 1959. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. 1959. 132p. Order from OTS. $3.00. UCRL-8706

S-wave $\bar{K}$-N scattering amplitudes, by U. Kruse and M. Nauenberg. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Sep 59. Contract W-7405-eng-48. 15p. Order from OTS. 50 cents. UCRL-8888

Physics Division semiannual report November 1958 through April 1959. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. Aug 59. Contract W-7405-eng-48. 46p. Order from OTS. $1.25. UCRL-8936

TUT-T5 - A two-dimensional Monte Carlo calculation of capture probabilities for the IBM-704, by J. Spanier, H. Kuehn and W. Guilinger. Westinghouse Electric Corp., Bettis Atomic Power Laboratory, Pittsburgh, Pa. Nov 59. Contract AT-11-1-GEN-14. 40p. Order from OTS. $1.25. WAPD-TM-125

TKO - A three-dimensional neutron-diffusion code for the IBM-704, by W. R. Cadwell. Westinghouse Corp. Bettis Atomic Power Laboratory, Pittsburgh, Pa. Oct 59. Contract AT-11-1-GEN-14. 44p. Order from OTS. $1.25. WAPD-TM-143

Progress Reports

Quarterly progress report April 1 - June 30, 1959. Brookhaven National Laboratory, Associated Universities, Inc., Upton, N. Y. 1959. 77p. Order from OTS. $2.25. BNL-564 (S-51)

Particle Accelerators and High-Voltage Machines

Effects of radial straight sections on the betatron oscillation frequencies in a spiral sector FFAG accelerator, by R. A. Dory and P. L. Morton. Midwestern Universities Research Association, Madison, Wis. Sep 59. Contract AT(11-1)-384. 10p. Order from OTS. 50 cents. MURA-514

Energy Division, Technical Division, Savannah River Lab., Aiken, S. Car. June 59. Contract AT(07-2)-1. 13p. Order from OTS. 50 cents. DP-388

Roughening of heat transfer surfaces as a method of increasing the heat flux at burnout. Progress report no. 1, by W. S. Durant and S. Mirshak. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Division, Technical Division, Savannah River Lab., Aiken, S. Car. July 59. Contract AT(07-2)-1. 20p. Order from OTS. 75 cents. DP-380

Heavy water moderated power reactors. Progress report for May and June 1959, by L. Bernath and L. Isakoff. E. I. du Pont de Nemours & Co., Explosives Dept., Atomic Energy Division, Technical Division, Wilmington, Dela. Sep 59. Contract AT(07-2)-1. 55p. Order from OTS. $1.50. DP-395

Apparatus for solvent extraction of milliliter quantities of highly radioactive solutions, by R. M. Wallace and H. Pollock. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Division, Technical Division , Savannah River Laboratory, Aiken, S. Car. Sep 50. Contract AT(07-2)-1. 10p. Order from OTS. 50 cents. DP-411

Heavy water components test reactor. Savannah River Plant. plans and estimate. E. I. du Pont de Nemours & Co. Explosives Dept., Atomic Energy Division, Technical division, Wilmington, Dela. Oct 59. Contract AT(07-2)-1. 31p. Order from OTS. $1.00. DP-412

Stable Isotope Separation

Isotope separation and isotope exchange. A bibliography with abstracts, by G. M. Begun. Oak Ridge National Laboratory, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 242p. Order from OTS. $3.50. ORNL-2852

Technology—Feed Materials

Removal of chloride from nitric acid by oxidation with permanganate, by G.P. Lang and others. Mallinckrodt Chemical Works. Uranium Division, Weldon Spring, Mo. Nov 59. Contract W-14-108-Eng-8. 25p. Order from OTS. 75 cents. MCW-1436

Pilot plant development of a sulfuric-acid solvent treatment process, by J. T. Krieg, N. G. Holloway, and N. Simecek. Mallinckrodt Chemical Works. Uranium Division, Weldon Spring, Mo. Nov 59. Contract W-14-108-Eng-8. 16p. Order from OTS. 75 cents. MCW-1438

Technology—Raw Materials

Solvent extraction recovery of vanadium (and uranium) from acid liquors with di(2-ethylhexyl) phosphoric acid, by D. J. Crouse and K. B. Brown. Oak Ridge National Laboratory, Oak Ridge, Tenn. (nd). Contract W-7405-eng-26. 81p. Order from OTS. $2.25. ORNL-2820